The DL05 & DL06 Family of Products

The DL05 micro PLC family includes eight different models. Each has eight inputs and six outputs in the base unit. The DL05 has one option card slot, which can be used to expand the I/O count, provide additional communications capability or add a real-time clock and battery back-up.

The larger DL06 micro PLC family has 20 inputs and 16 outputs in the base unit. The DL06 has four option card slots which can be used to add I/O or provide additional communications options.

Instruction sets

The DL05 CPU offers PID capability, high-speed counting, and the same powerful instruction set as our popular DL250 CPU. All DL05 PLCs have two built-in RS-232C communications ports that can be used for programming, operator interface, networking, etc.

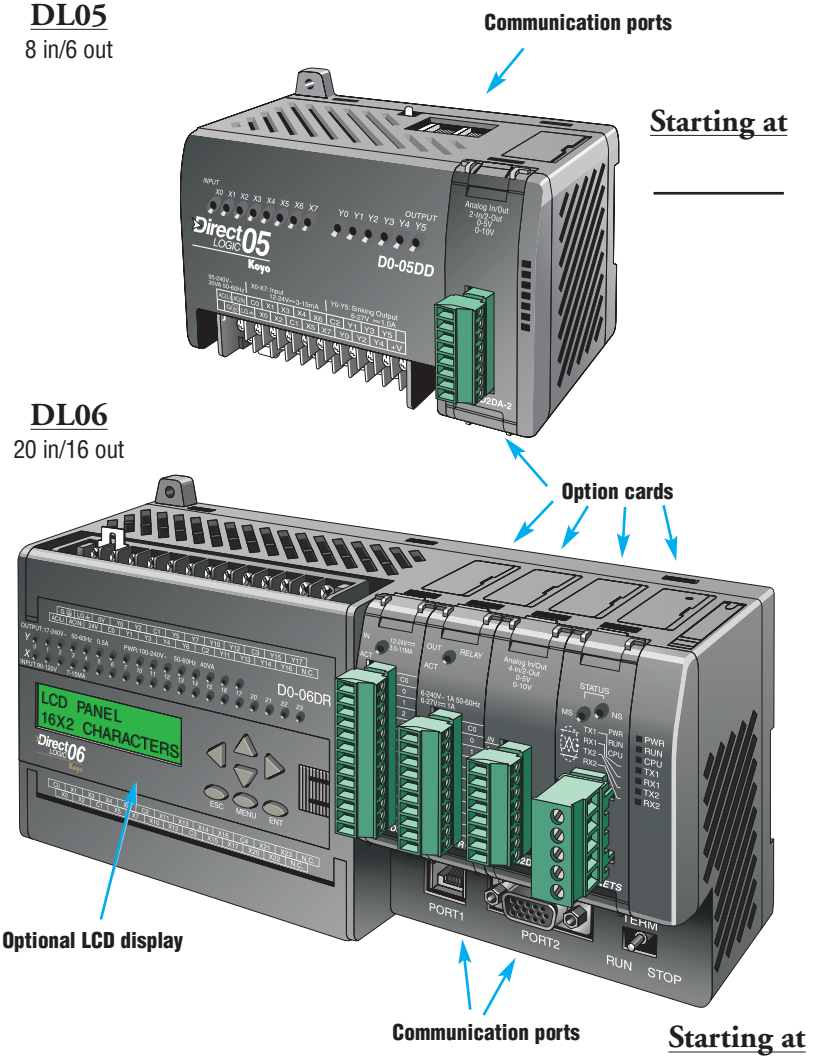
The DL06 CPU offers PID capability, floating point number handling, and an instruction set very similar to our new D2-260 CPU. Many powerful new instructions are included. All DL06 PLCs have two built-in communications ports that can be used for programming, operator interface, networking, etc. One of the DL06 ports is a multi-function port capable of RS232C, RS422, or RS485 communications.

Power options

The DL05 and DL06 families have AC and DC power options. They are also offered with a variety of I/O options. You can explore the Quick Selection Guide on the next page to choose the right PLC for your application.

High-speed inputs and outputs

Units with DC inputs have selectable high-speed input features on three input points (DL05) or four input points (DL06). Units with DC outputs can use the first two outputs as a single bi-directional pulse output. Detailed specifications for each model appear later in this section.



General Specifications	AC Powered	DC Powered
Power	110/220VAC (+ 10%, -15%), 50-60Hz	12/24VDC
Input Voltage Range	95-240VAC	12-24VDC
Maximum Power	30VA (DL05) 40VA (DL06)	20W
Maximum Inrush Current	13A, 1ms (240VAC)	10A < 1ms
Storage Temperature	-4°F to 158°F (-20°C to 70°C)	
Ambient Operating Temperature	32°F to 131°F (0°C to 55°C)	
Ambient Humidity	5% - 95% relative humidity (non-condensing)	
Vibration Resistance	MIL STD 810C, Method 514.2	
Shock Resistance	MIL STD 810C, Method 516.2	
Noise Immunity	NEMA (ICS3-304)	
Atmosphere	No corrosive gases	

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Quick Selection Guide

110/220 (+10%, -15%) VAC Power Options

DL05

D0-05AA
- 8 AC inputs
- 6 AC outputs, 0.5A/point

D0-05AD
- 8 AC inputs
- 6 DC outputs (sinking), 1.0A/point
  - Two outputs can be used as a single bi-directional 7kHz pulse output

D0-05AR
- 8 AC inputs
- 6 relay outputs, 2A/point

D0-05DA
- 8 DC inputs
  - Three inputs are filtered inputs, can also be configured as a single 5kHz high-speed counter, interrupt input, or pulse catch input
- 6 AC outputs, 0.5A/point

D0-05DD
- 8 DC inputs
  - Three inputs are filtered inputs, can also be configured as a single 5kHz high-speed counter, interrupt input, or pulse catch input
- 6 DC outputs (sinking), 1.0A/point
  - Two outputs can be used as a single bi-directional 7kHz pulse output

D0-05DR
- 8 DC inputs
  - Three inputs are filtered inputs, can also be configured as a single 5kHz high-speed counter, interrupt input, or pulse catch input
- 6 relay outputs, 2A/point

DL06

D0-06AA
- 20 AC inputs
- 16 AC outputs, 0.5A/point

D0-06AR
- 20 AC inputs
- 16 relay outputs, 2A/point

D0-06DA
- 20 DC inputs
  - Three inputs are filtered inputs, can also be configured as a single 7kHz high-speed counter, interrupt input, or pulse catch input
- 16 AC outputs, 0.5A/point

D0-06DD1
- 20 DC inputs
  - Three inputs are filtered inputs, can also be configured as a single 7kHz high-speed counter, interrupt input, or pulse catch input
- 16 DC outputs (sinking), 1.0A/point
  - Two outputs can be used as a single bi-directional 10kHz pulse output

D0-06DD2
- 20 DC inputs
  - Three inputs are filtered inputs, can also be configured as a single 7kHz high-speed counter, interrupt input, or pulse catch input
- 16 DC outputs (sourcing), 1.0A/point
  - Two outputs can be used as a single bi-directional 10kHz pulse output

D0-06DR
- 20 DC inputs
  - Three inputs are filtered inputs, can also be configured as a single 7kHz high-speed counter, interrupt input, or pulse catch input
- 16 relay outputs, 2A/point

12/24 VDC Power Options

DL05

D0-05DD-D
- 8 DC inputs
  - Three inputs are filtered inputs, can also be configured as a single 5kHz high-speed counter, interrupt input, or pulse catch input
- 6 DC outputs (sinking), 1.0A/point
  - Two outputs can be used as a single bi-directional 7kHz pulse output

D0-05DR-D
- 8 DC inputs
  - Three inputs are filtered inputs, can also be configured as a single 5kHz high-speed counter, interrupt input, or pulse catch input
- 6 Relay outputs, 2A/point

DL06

D0-06DD1-D
- 20 DC inputs
  - Three inputs are filtered inputs, can also be configured as a single 7kHz high-speed counter, interrupt input, or pulse catch input
- 16 DC outputs (sinking), 1.0A/point
  - Two outputs can be used as a single bi-directional 10kHz pulse output

D0-06DR-D
- 20 DC inputs
  - Three inputs are filtered inputs, can also be configured as a single 7kHz high-speed counter, interrupt input, or pulse catch input
- 16 relay outputs, 2A/point

Note: High speed outputs cannot be used if high-speed inputs are in use, and high-speed inputs cannot be used if high-speed outputs are in use. Analog inputs and outputs can be accommodated with option cards, which are available for both the DL05 and DL06.

Features at a Glance

The DL05 and DL06 micro PLCs are complete self-contained systems. The CPU, power supply, and I/O are all included inside the same housing. Option modules are available to expand the capability of each PLC family for more demanding applications. The standard features of these PLCs are extraordinary and compare favorably with larger and more expensive PLCs.

The specification tables to the right are meant for quick reference only. Detailed specifications and wiring information for each model of the DL05 and DL06 PLCs begin on page 279.

Program capacity

Most boolean ladder instructions require a single word of program memory. Other instructions, such as timers, counters, etc., require two or more words. Data is stored in V-memory in 16-bit registers.

Performance

The performance characteristics shown in the tables represent the amount of time required to read the inputs, solve the Relay Ladder Logic program and update the outputs.

Instructions

A complete list of instructions is available at the end of this section.

Communications

The DL05 and DL06 offer powerful communication features normally found only on more expensive PLCs.

Special features

The DC input and DC output PLCs offer high-speed counting or pulse output. Option card slots allow for discrete I/O expansion, analog I/O, or additional communication options.

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DL05 CPU Specifications

System capacity

Total memory available (words)	6K
Ladder memory (words)	2,048
V-memory (words)	4,096
User V-memory	3,968
Non-volatile user V-memory	128
Battery backup	Yes[1]
Total built-in I/O	14
Inputs	8
Outputs	6
I/O expansion	Yes[1]

Performance

Contact execution (Boolean)	0.7µs
Typical scan (1K Boolean)[2]	1.5-3ms.

Instructions and diagnostics

RLL ladder style	Yes
RLLPLUS/flowchart style (Stages)	Yes/256
Run-time editing	Yes
Scan	Variable/fixed
Number of Instructions	133
Types of Instructions:	
Control relays	512
Timers	128
Counters	128
Immediate I/O	Yes
Subroutines	Yes
For/next loops	Yes
Timed interrupt	Yes
Integer math	Yes
Floating-point math	No
PID	Yes
Drum sequencers	Yes
Bit of word	Yes
ASCII print	Yes
Real-time clock/calendar	Yes[1]
Internal diagnostics	Yes
Password security	Yes
System and user error log	No

Communications

Built-in ports	Two RS-232C
Protocols supported:	
K-sequence (proprietary protocol)	Yes
DirectNet master/slave	Yes
MODBUS RTU master/slave	Yes
ASCII out	Yes
Baud rate	
Port 1	9,600 baud (fixed)
Port 2	selectable 300-38,400 baud (default 9,600)

Specialty Features

Filtered inputs	Yes[3]
Interrupt input	Yes[3]
High speed counter	Yes, 5kHz[3]
Pulse output	Yes, 7kHz[3]
Pulse catch input	Yes[3]

1- These features are available with use of certain option cards. Option card specifications are located later in this section.

2- Our 1K program includes contacts, coils, and scan overhead. If you compare our products to others, make sure you include their scan overhead.

3- Input features only available on units with DC inputs and output features only available on units with DC outputs.

DL06 CPU Specifications

System capacity

Total memory available (words)	14.8K
Ladder memory (words)	7680
V-memory (words)	7616
User V-memory	7488
Non-volatile user V-memory	128
Built-in battery backup	Yes
Total I/O	36
Inputs	20
Outputs	16
I/O expansion	Yes[1]

Performance

Contact execution (Boolean)	0.6µs
Typical scan (1K Boolean)[2]	1-2ms.

Instructions and diagnostics

RLL ladder style	Yes
RLLPLUS/flowchart style (Stages)	Yes/1024
Run-time editing	Yes
Scan	Variable/fixed
Number of Instructions	229
Types of Instructions:	
Control relays	1024
Timers	256
Counters	128
Immediate I/O	Yes
Subroutines	Yes
For/next loops	Yes
Table functions	Yes
Timed interrupt	Yes
Integer math	Yes
Trigonometric functions	Yes
Floating-point math	Yes
PID	Yes
Drum sequencers	Yes
Bit of word	Yes
Number type conversion	Yes
ASCII in, out, print	Yes
LCD instruction	Yes
Real-time clock/calendar	Yes
Internal diagnostics	Yes
Password security	Yes
System and user error log	No

Communications

Built-in ports:	One RS-232C
	One multi-function RS232C/RS422/RS485
Protocols supported:	
K-sequence (proprietary protocol)	Yes
DirectNet master/slave	Yes
MODBUS RTU master/slave	Yes
ASCII in/out	Yes
Baud rate	
Port 1	9,600 baud (fixed)
Port 2	selectable 300-38,400 baud (default 9,600)

Specialty Features

Filtered inputs	Yes[3]
Interrupt input	Yes[3]
High speed counter	Yes, 7kHz[3]
Pulse output	Yes, 10kHz[3]
Pulse catch input	Yes[3]

1- These features are available with use of certain option cards. Option card specifications are located later in this section.

2- Our 1K program includes contacts, coils, and scan overhead. If you compare our products to others, make sure you include their scan overhead.

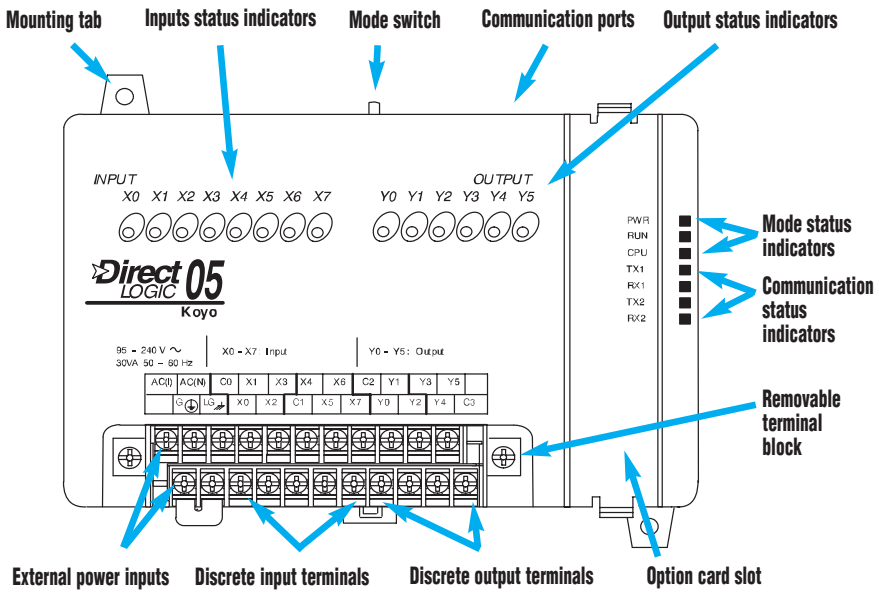
3- Input features only available on units with DC inputs and output features only available on units with DC outputs.

Features at a Glance

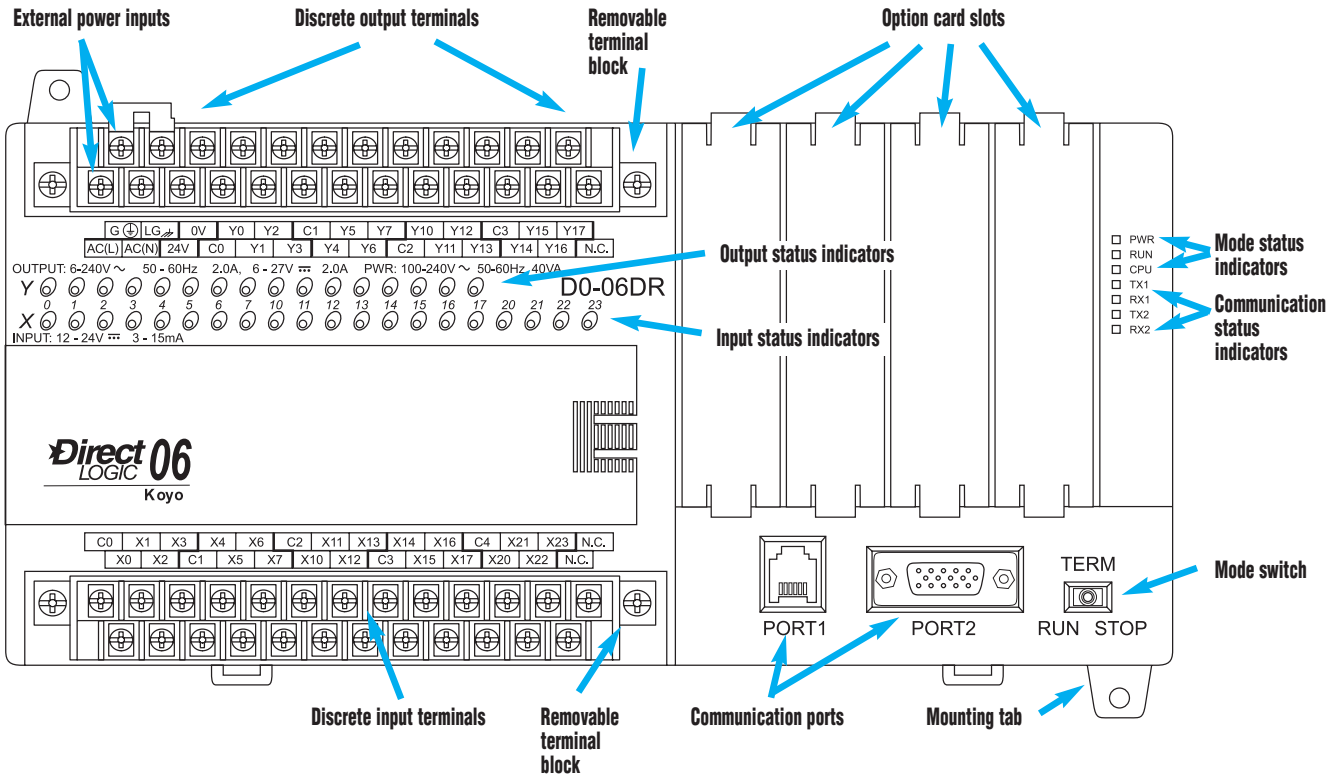
*Direct*SOFT32 software

The DL05 and DL06 PLCs use the same familiar *Direct*SOFT32 programming software that our larger PLCs use. Special low-priced software versions are available for the micro PLCs, but if you already own the complete programming package, that will work too (version 4.0 or later).

The PC-PGM-105 software is sufficient to program the DL05 PLC and the DL105 PLC (which is featured in the next section). Version 2.4 is required, but we always recommend the latest version for the most robust features. The DL06 PLC requires Version 4.0 of *Direct*SOFT32, and comes bundled with the DL05 and DL105 software in the PC-PGM-BRICK package.



Hardware features diagrams

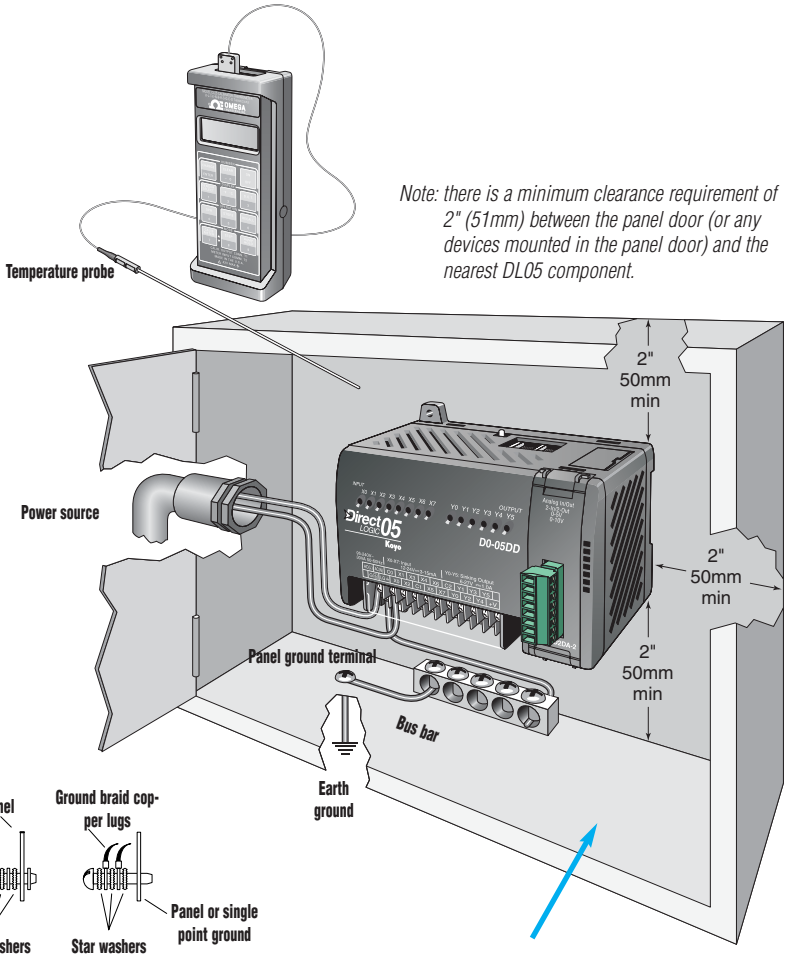


Product Dimensions and Installation

It is important to understand the installation requirements for your DL05 or DL06 system. Your knowledge of these requirements will help ensure that your system operates within its environmental and electrical limits.

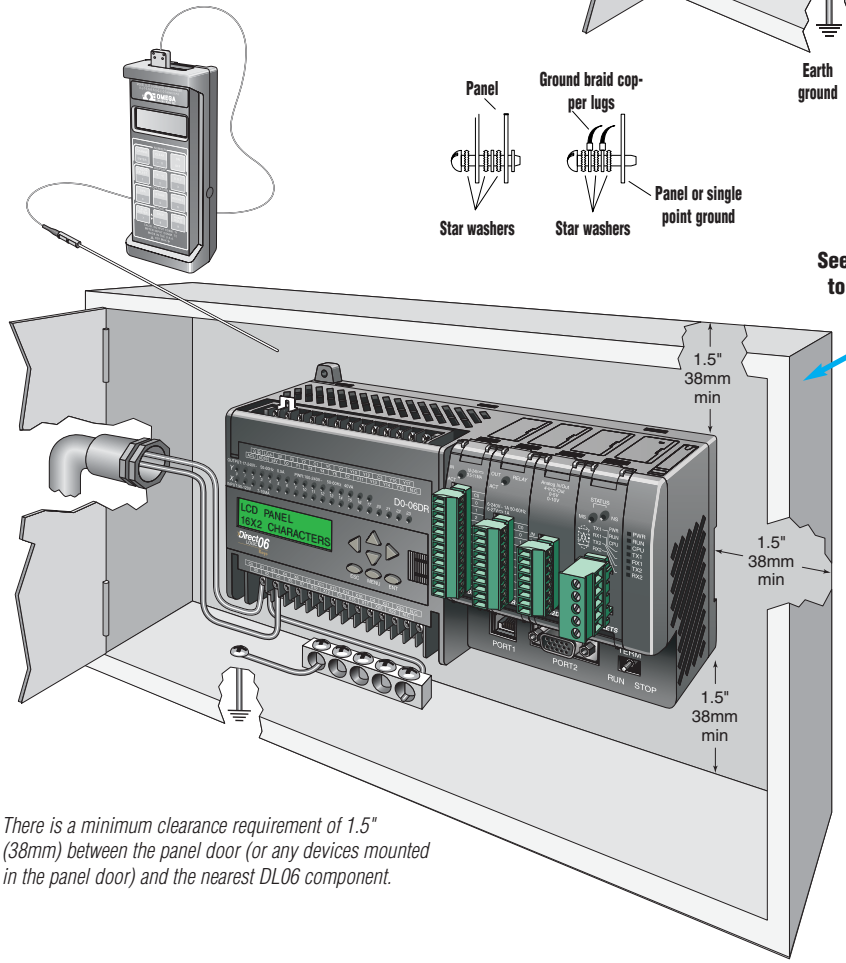
Plan for safety

This desk reference should never be used as a replacement for the user manual. You can purchase, download free, or view online the user manuals for these products. The D0-USER-M is the publication for the DL05 PLCs, and the D0-06USER-M is the publication for the DL06 PLCs. The D0-OPTIONS-M is the user manual for the option cards. These user manuals contain important safety information that must be followed. The system installation should comply with all appropriate electrical codes and standards.



Note: there is a minimum clearance requirement of 2" (51mm) between the panel door (or any devices mounted in the panel door) and the nearest DL05 component.

See the enclosure section of this desk reference to find an enclosure that fits your application.



Note: There is a minimum clearance requirement of 1.5" (38mm) between the panel door (or any devices mounted in the panel door) and the nearest DL06 component.

Environmental Specifications for DL05 and DL06	
Storage Temperature	-4º F-158ºF (-20ºC to 70ºC)
Ambient Operating Temperature	32ºF-131ºF (0º to 55ºC)
Ambient Humidity	5 to 95% relative humidity (non-condensing)
Vibration Resistance	MIL STD 810C Method 514.2
Shock Resistance	MIL STD 810C Method 516.2
Noise Immunity	NEMA (ICS3-304)
Atmosphere	No corrosive gases

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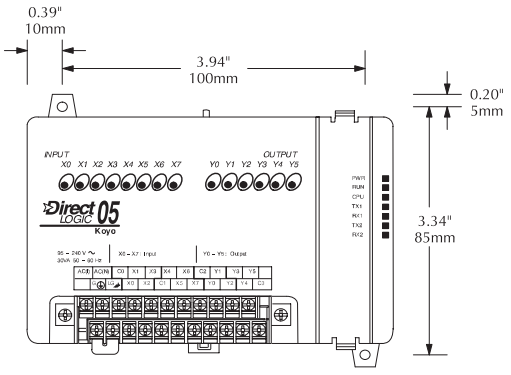
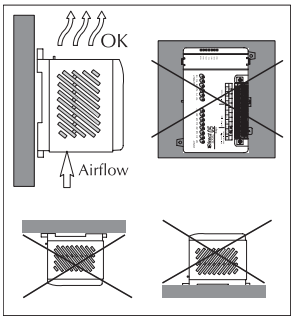
Product Dimensions and Installation

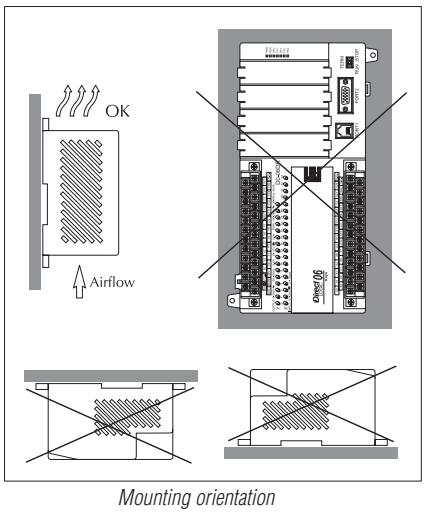
Unit dimensions and mounting orientation

DL05 and DL06 PLCs must be mounted properly to ensure ample airflow for cooling purposes. It is important to follow the unit orientation requirements and to verify that the PLC's dimensions are compatible with your application. Notice particularly the grounding requirements and the recommended cabinet clearances.

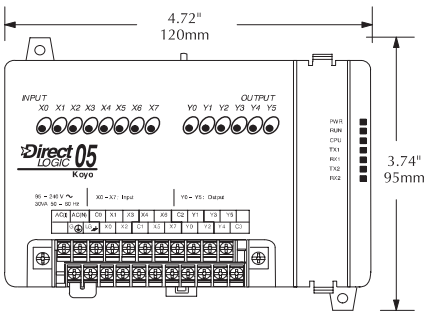


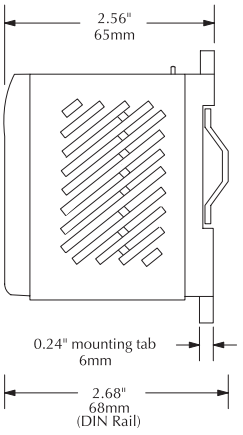


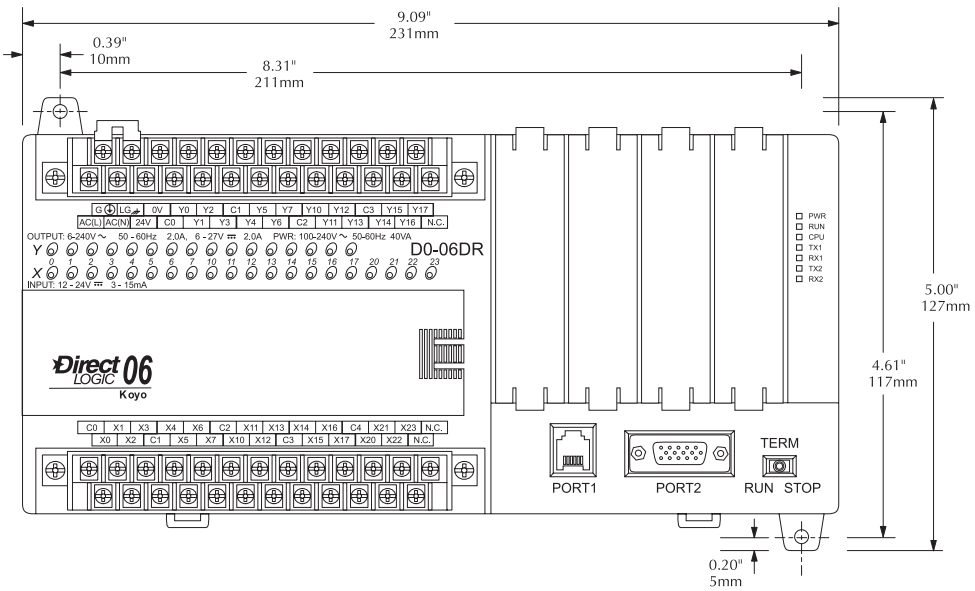
Mounting orientation

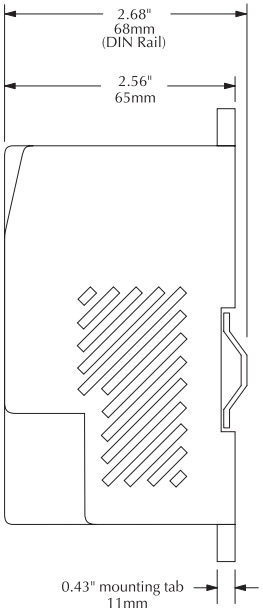


Mounting orientation









Choosing the I/O Type

The DL05 and DL06 product families offer a number of different I/O configurations. Choose the configuration that is right for your application. Also, keep in mind that both the DL05 and the DL06 PLCs offer the ability to add I/O with the use of option cards.

Fixed discrete I/O

All DL05 micro PLCs have eight *built-in* inputs and six *built-in* outputs on the base unit. The DL06 micro PLCs have 20 *built-in* inputs and 16 *built-in* outputs on the base unit. We offer the most common I/O types for your convenience, including AC inputs and outputs, DC sinking and sourcing inputs and outputs, and relay outputs. Refer to the tables to the right to see the I/O combinations available and their voltage ranges.

Option card slots

The DL05 has one option card slot and the DL06 has four option card slots. Check out the discrete and analog I/O you can add by purchasing inexpensive option cards. Option card specialty modules are also available and are discussed later in this section.

Automatically assigned addresses

The DL05 uses automatic addressing, so for the vast majority of applications, there is no setup required. We use octal addressing for our products, which means there are no 8s or 9s. The DL05's eight input points use addresses X0-X7, and the six output points use addresses Y0-Y5. Similarly, the DL06 uses addresses X0-X23 and Y0-Y17.

Review the I/O specs and wiring diagrams

The Base Unit I/O tables give a brief description of the I/O combinations offered for the DL05 and DL06 PLCs. The I/O specifications are discussed in more detail later in this section.

DL05 Base Unit I/O Table

Part Number	Inputs			Outputs			
	I/O type/ commons	Sink or source	Voltage ranges	I/O type/ commons	Sink or source	Voltage/current ratings	
D0-05AR	AC/2	N/A	90-120VAC	Relay/2	N/A	6-27VDC, 2A 6-240VAC, 2A	
D0-05DR	DC/2	Sink or Source	12-24VDC	Relay/2	N/A	6-27VDC, 2A 6-240VAC, 2A	
D0-05AD	AC/2	N/A	90-120VAC	DC/1	Sink	6-27VDC, 0.5A (Y0-Y1) 6-27VDC, 1.0A (Y2-Y5)	
D0-05DD	DC/2	Sink or Source	12-24VDC	DC/1	Sink	6-27VDC, 0.5A (Y0-Y1) 6-27VDC, 1.0A (Y2-Y5)	
D0-05AA	AC/1	N/A	90-120VAC	AC/2	N/A	17-240VAC 47-63Hz 0.5A	
D0-05DA	DC/2	Sink or Source	12-24VDC	AC/2	N/A	17-240VAC 47-63Hz 0.5A	
D0-05DR-D	DC/2	Sink or Source	12-24VDC	Relay/2	N/A	6-27VDC, 2A 6-240VAC, 2A	
D0-05DD-D	DC/2	Sink or Source	12-24VDC	DC/1	Sink	6-27VDC, 0.5A (Y0-Y1) 6-27VDC, 1.0A (Y2-Y5)	

Sinking/sourcing

If you are using a DC field device, you should consider whether that device requires a sinking or sourcing PLC I/O configuration. For more information on sinking and sourcing concepts, please refer to the Appendix of this catalog.

Sink/source inputs — All *built-in* DC inputs on the DL05 and DL06 micro PLCs can be wired in a sinking or sourcing configuration. However, all inputs on a single common must use the same configuration. In some cases, the DC inputs on option cards are fixed as sinking or sourcing. Refer to the table on the next page.

Sinking outputs — All *built-in* DC outputs on the DL05 are sinking. The DL06 family offers three PLCs with sinking DC outputs, and one with sourcing outputs.

Sourcing outputs — The DL06 PLC family includes the D0-06DD2 with sourcing outputs. If a sourcing output is required, you might also consider using either the D0-xxTD2 option card with sourcing outputs, which can also be installed in a DL05 or DL06 PLC.

High-speed inputs and pulse outputs

DL05s and DL06s with DC inputs offer high-speed input features, and DC output units offer pulse output features. The first three DC inputs on the DL05 PLCs are set up by default as filtered inputs with a 10 ms filter. Likewise, the first four DC inputs on the DL06 PLCs are set to the same default value. By entering a setup code in a special V-memory location, you can choose other features. In some modes of operation, you have a choice as to how you use each point. For example, if you use X0 as an up counter, you can use X2 as a reset input for the counter or as a filtered discrete input. If these features interest you, take a look at the detailed high-speed I/O descriptions found later in this section.

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Choosing the I/O Type

DL06 Base Unit I/O Table							
Part Number	Inputs			Outputs			
	I/O Type/ Commons	Sink or source	Voltage Ranges	I/O Type/ Commons	Sink or Source	Voltage/current ratings	
D0-06AA	AC/5	N/A	90-120VAC	AC/4	N/A	17-240VAC, 0.5A 47-63Hz	
D0-06AR	AC/5	N/A	90-120VAC	Relay/4	N/A	6-27VDC, 2A 6-240VAC, 2A	
D0-06DA	DC/5	Sink or source	12-24VDC	AC/4	N/A	17-240VAC, 0.5A 47-63Hz	
D0-06DD1	DC/5	Sink or source	12-24VDC	DC/4	Sink	6-27VDC, 0.5A (Y0-Y1) 6-27VDC, 1.0A (Y2-Y17)	
D0-06DD2	DC/5	Sink or source	12-24VDC	DC/4	Source	12-24VDC, 0.5A (Y0-Y1) 12-24VDC, 1.0A (Y2-Y17)	
D0-06DR	DC/5	Sink or source	12-24VDC	Relay/4	N/A	6-27VDC, 2A 6-240VAC, 2A	
D0-06DD1-D	DC/5	Sink or source	12-24VDC	DC/4	Sink	6-27VDC, 0.5A (Y0-Y1) 6-27VDC, 1.0A (Y2-Y17)	
D0-06DR-D	DC/5	Sink or source	12-24VDC	Relay/4	N/A	6-27VDC, 2A 6-240VAC, 2A	

Discrete I/O Option Cards							
Part Number	Inputs			Outputs			
	I/O Type/ Number/ Commons	Sink or source	Voltage Ranges	I/O Type/ Number/ Commons	Sink or Source	Voltage/Current Ratings	
D0-07CDR	DC/4/1	Sink or source	12-24VDC	Relay/3/1	N/A	6-27VDC, 1A 6-240VAC, 1A	
D0-08CDD1	DC/4/2	Sink or source	12-24VDC	DC/4/2	Sink	6-27VDC, 0.3A	
D0-08TR	N/A	N/A	N/A	Relay/8/2	N/A	6-27VDC, 1A 6-240VAC, 1A	
D0-10ND3	DC/10/2	Sink or source	12-24VDC	N/A	N/A	N/A	
D0-10TD1	N/A	N/A	N/A	DC/10/2	Sink	6-27VDC, 0.3A	
D0-10TD2	N/A	N/A	N/A	DC/10/2	Source	12-24VDC, 0.3A	
D0-16ND3	DC/16/4	Sink or source	20-28VDC	N/A	N/A	N/A	
D0-16TD1	N/A	N/A	N/A	DC/16/2	Sink	6-27VDC, 0.1A	
D0-16TD2	N/A	N/A	N/A	DC/16/2	Source	12-24VDC, 0.1A	

Analog I/O

By using option cards, you can add analog inputs or outputs to your DL05 or DL06 PLC. The table below shows the input and output types at a glance. Detailed specifications are provided later in this section.

Analog I/O Option Cards					
Part Number	Inputs		Outputs		
	No.	Input Type	No.	Output Type	
F0-04AD-1	4	0-20mA or 4-20mA	0	N/A	
F0-4AD2DA-1	4	0-20mA or 4-20mA	2	0-20mA or 4-20mA	
F0-2AD2DA-2	2	0-5VDC or 0-10VDC	2	0-5VDC or 0-10VDC	
F0-4AD2DA-2	4	0-5VDC or 0-10VDC	2	0-5VDC or 0-10VDC	

Power budgeting

No power budgeting is necessary for the DL05. The built-in power supply is sufficient for powering the base unit, any of the option cards, the handheld programmer, and even a DV1000 operator interface.

Power budgeting is necessary for the DL06. With four option card slots and an optional LCD display, it is necessary to verify that sufficient power is available for all optional devices. Power budgeting is described in detail on page 275 and in the DL06 User Manual.

Networking the DL05 and DL06

All DL05 and DL06 PLCs have built-in networking capability. The DL05 family offers two 6-pin, RS-232C ports. You can use these ports for programming, networking, or connecting an operator interface device. The RS232C ports support point-to-point communications using the optional D0-CBL cable. If you need to create a multi-drop network or if you require longer distances between devices, you can use the FA-ISONET at each DL05 to convert the RS232C signal to RS422 or RS485.

The DL06 family of PLCs offers even greater communications flexibility. Port 1 is a fixed baud rate port identical to port 1 on the DL05 PLCs, but port 2 is a multi-function port that can be used as RS232C, RS422, or RS485 without using external converters. This allows you to create multi-drop networks with minimal installation headaches.

The DL06 PLCs have *next generation* simplified instructions for handling both MODBUS RTU and ASCII communications. The new ASCII instruction set makes it practical to connect an ASCII input or output device to the DL06. See page 274 for more information.

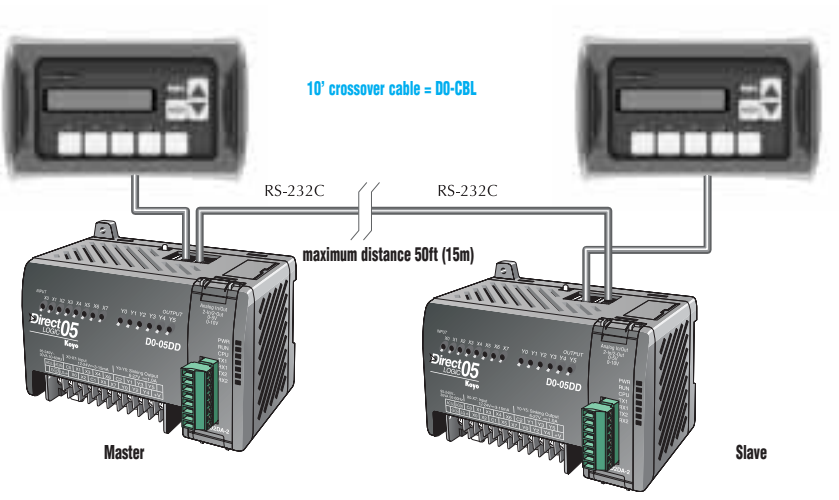
Protocols supported

Each port is capable of communicating using K-sequence, *Direct*NET and MODBUS protocols. Port 1 can only be a slave for each of the protocols. Port 2 can serve as a K-sequence slave or a network master or slave for either *Direct*NET or MODBUS RTU protocols.

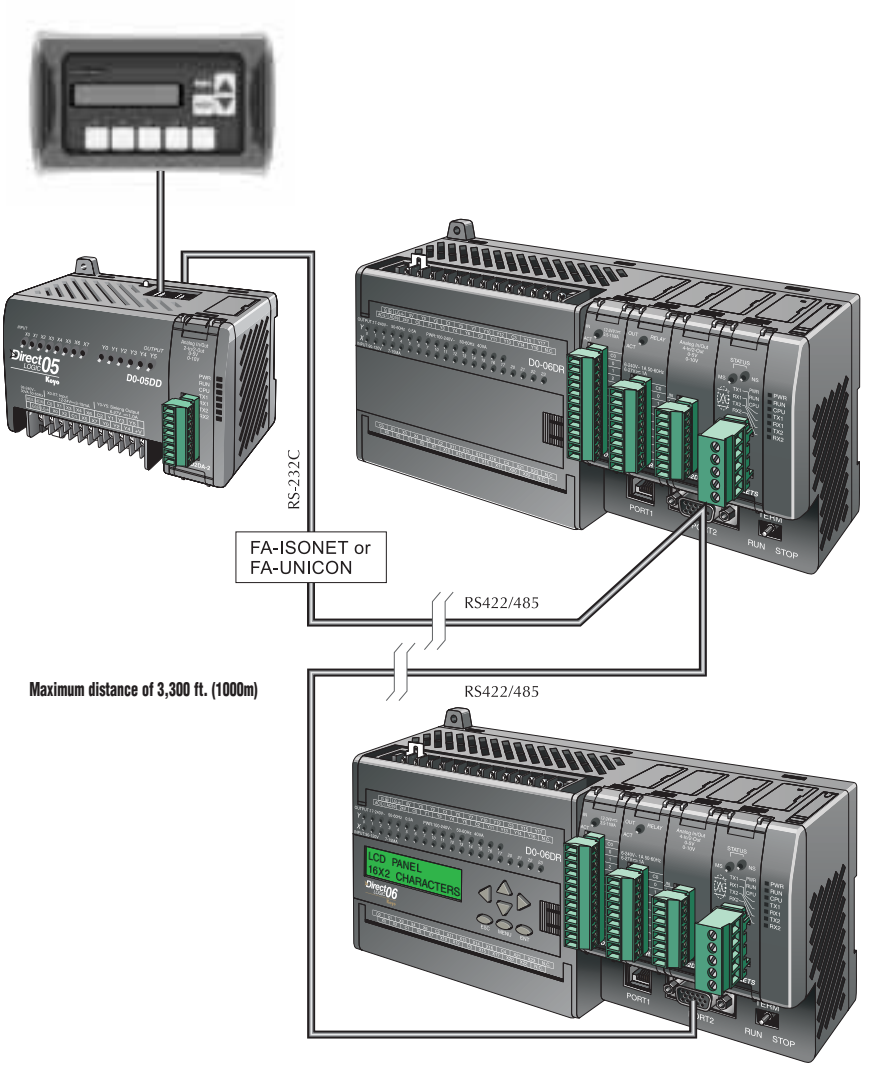
DeviceNet

We also offer an option card that allows you to connect a DL05 or DL06 PLC to a DeviceNet network as a slave device. Our D0-DEVNETS option card plugs into any DL05 or DL06 PLC. For more information, see page 296.

Point-to-point



Multi-drop



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Ports, Status Indicators, and Modes

Port 1

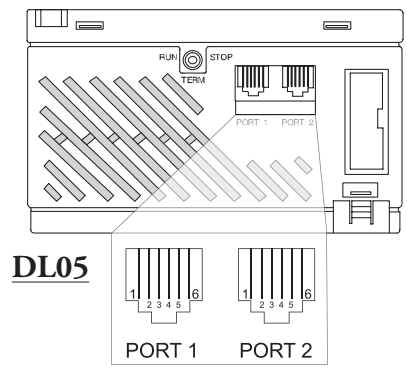
Port 1 is a 6-pin, fixed configuration port and has the same pin assignments on the DL05 and the DL06. Please refer to the table and diagrams on this page. This port can be used to connect to an HPP, *Direct*SOFT, an operator interface, or other external device. Features include:

- 9600 baud
- 8 data bits
- Odd parity
- 1 start bit, 1 stop bit
- Station address of 1
- Asynchronous, half-duplex, DTE

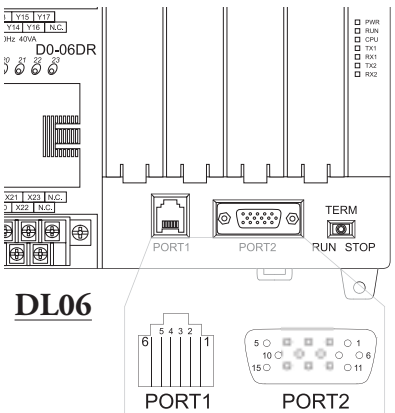
protocols supported (as slave):

K sequence, ***Direct***NET, MODBUS

DL05 & DL06 Port 1 Pin Descriptions		
1	0V	Power (-) connection (GND)
2	5V	Power (+) connection
3	RXD	Receive data (RS-232C)
4	TXD	Transmit data (RS-232C)
5	5V	Power (+) connection
6	0V	Power (-) connection (GND)



6-pin Female Modular Connector



6-pin Female Modular Connector

15-pin Female D-sub Connector

Port 2

Port 2 is a configurable port on both the DL05 and the DL06 PLCs. The DL05 PLC uses a 6-pin modular connector and offers RS232C communications only. The DL06 PLC uses a 15-pin HD-sub connector and offers RS232C, RS422, or RS485 communications. Please refer to the table and diagrams on this page for more information. This port can be used to connect to an HPP, *Direct*SOFT, an operator interface, or other external device. Features of port 2 include:

- 300, 600, 1200, 2400, 4800, 9600 (default), 19,200, 38,400 baud
- 8 data bits
- Odd (default), even, or no parity
- 1 start bit, 1 stop bit
- Station address:
  1 (default)
  1-90 DirectNET, K sequence
  1-247 MODBUS RTU

asynchronous, half-duplex, DTE

protocols supported:

K sequence (slave), ***Direct***NET (master/slave), MODBUS (master/slave)

DL05 Port 2 Pin Descriptions		
1	0V	Power (-) connection (GND)
2	5V	Power (+) connection
3	RXD	Receive data (RS-232C)
4	TXD	Transmit data (RS-232C)
5	RTS	Ready to send
6	0V	Power (-) connection (GND)

DL06 Port 2 Pin Descriptions		
1	5V	Power (+) connection
2	TXD	Transmit data (RS-232C)
3	RXD	Receive data (RS-232C)
4	RTS	Ready to Send (RS232C)
5	CTS	Clear to send
6	RXD-	Receive data (-) (RS-422/485)
7	0V	Power (-) connection (GND)
8	0V	Power (-) connection (GND)
9	TXD+	Transmit Data (+) (RS-422/485
10	TXD-	Transmit Data (-) (RS-422/485)
11	RTS+	Ready to Send (+) (RS-422/485)
12	RTS-	Ready to Send (-) (RS-422/485)
13	RXD+	Receive Data (+) (RS-422/485)
14	CTS+	Clear to send (+) (RS-422/485)
15	CTS-	Clear to send (-) (RS-422/485)

DL05 and DL06 status indicators

Status Indicators		
Indicator	***Status***	***Meaning***
PWR	ON	Power good
	OFF	Power failure
RUN	ON	CPU is in Run Mode
	OFF	CPU is in Stop or Program Mode
CPU	ON	CPU self diagnostics error
	OFF	CPU self diagnostics good
TX1	ON	Data is being transmitted by the CPU-Port 1
	OFF	No data is being transmitted by the CPU-Port 1
RX1	ON	Data is being received by the CPU-Port 1
	OFF	No data is being received by the CPU-Port 1
TX2	ON	Data is being transmitted by the CPU-Port 2
	OFF	No data is being transmitted by the CPU-Port 2
RX2	ON	Data is being received by the CPU-Port 2
	OFF	No data is being received by the CPU-Port 2

DL05 and DL06 mode switches

Mode Switch Position	CPU Action
RUN (Run Program)	CPU is forced into the RUN mode if no errors are encountered. No program changes are allowed by the programming/monitoring device.
TERM (Terminal)	RUN PROGRAM and the TEST modes are available. Mode and program changes are allowed by the programming/monitoring device.
STOP	CPU is forced into the STOP mode. No changes are allowed by the programming/monitoring device.

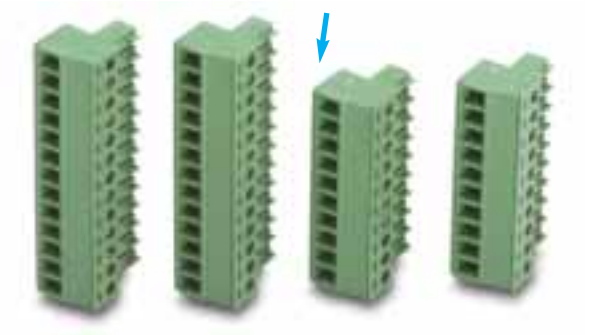
Use the optional low profile 15-pin adapter to make option card wiring easier.

D0-06ADPTR

ACCESSORIES

DL05, DL06, and Option Card Accessories		
Part Number	*Description*	
D0-MC-BAT	Replacement battery for the D0-01MC memory option modules (DL05 only).	
F0-IOCON	DL05 or DL06 analog option card replacement terminal blocks, quantity two.	
D0-CBL	12ft. (3.66m) RS232C shielded networking cable without RTS connections for DL05 or DL06 RJ12 networking ports. Enables direct networking of two PLCs.	
D0-ACC-1	DL05 accessory pack includes one each of the I/O terminal block, I/O terminal block cover, and option slot cover.	
D0-ACC-2	DL06 replacement terminal blocks, terminal block covers, terminal block labels and short bar.	
D0-ACC-3	DL06 replacement option card slot covers, DL06 top covers, LCD slot cover, and lower access panel cover.	
D0-ACC-4	D0 discrete I/O option card replacement terminal blocks, includes 13-position and 10-position.	
D0-06ADPTR	DL06 15-pin high density D-sub vertical adapter for DL06 Port 2 serial communications port.	

Discrete option card terminal blocks
D0-ACC-4



DL05 option card slot covers, I/O terminal block, and I/O terminal block cover
D0-ACC-1

DL06 replacement option card slot covers, DL06 top covers, LCD slot cover, and lower access panel cover
D0-ACC-3

DL06 replacement terminal blocks, terminal block covers, terminal block labels and short bar
D0-ACC-2

DL06 15-pin high density D-sub port adapter
D0-06ADPTR

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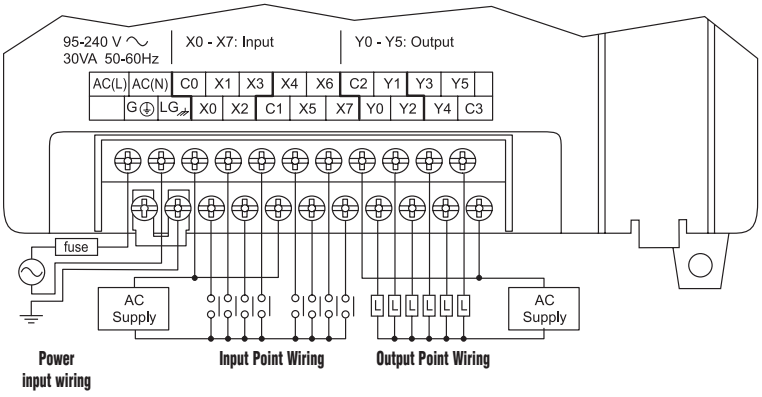
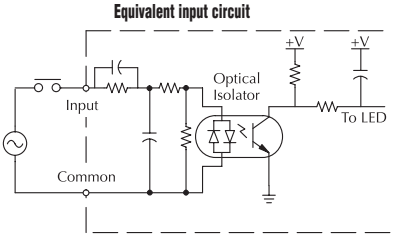
DL05 I/O Specifications

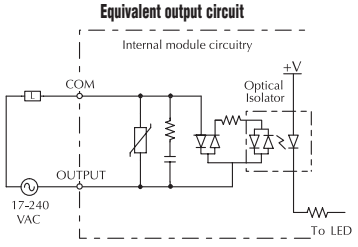
D0-05AA

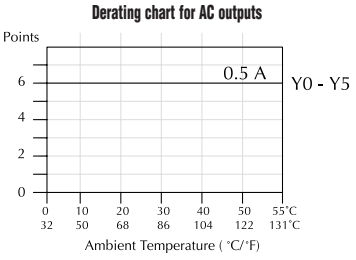
Wiring diagram and specifications

D0-05AA Specifications		
AC Power Supply Specifications	Voltage Range	95-240VAC (30VA)
AC Input Specifications	Number of Input Pts.	8
	Number of Commons	2 (isolated)
	Input Voltage Range	90-120VAC
	Frequency Range	47-63Hz
	Input Current	8mA @ 100 VAC at 50 Hz 10mA @ 100 VAC at 60Hz
	On Current/Voltage Level	>6mA/75VAC
	OFF Current/ Voltage Level	<2mA/20VAC
	OFF to ON Response	<40ms
	ON to OFF Response	<40ms
	Fuses	None
AC Output Specifications	Number of Output Points	6
	Number of Commons	2 (isolated)
	Output Voltage Range	17-240VAC 47-63Hz
	Peak Voltage	264VAC
	ON Voltage Drop	1.5 VAC>50mA 4.0VAC<50mA
	Maximum Current	0.5A/pt 1.5A/common
	Maximum Leakage Current	4mA at 264VAC
	Maximum Inrush Current	10A for 10ms
	Minimum Load	10mA
	OFF to ON Response	1ms
	ON to OFF Response	1ms + 1/2 cycle
	Fuses	None (external recommended)


95-240 V
30VA 50-60Hz
X0 - X7: Input
Y0 - Y5: Output
AC(L) AC(N) C0 X1 X3 X4 X6 C2 Y1 Y3 Y5
G LG X0 X2 C1 X5 X7 Y0 Y2 Y4 C3
fuse
AC Supply
AC Supply
Power input wiring
Input Point Wiring
Output Point Wiring







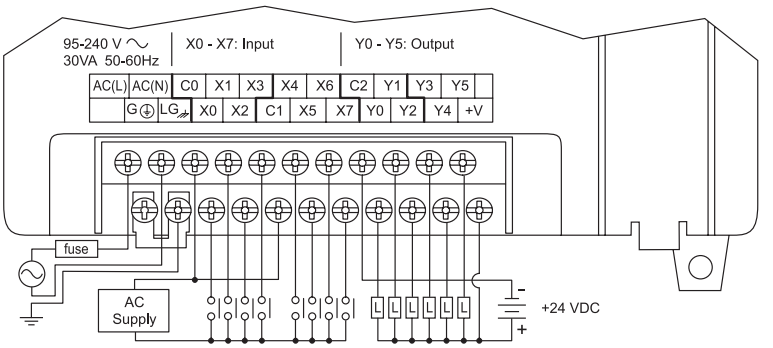
DL05 I/O Specifications

D0-05AD

Wiring diagram and specifications

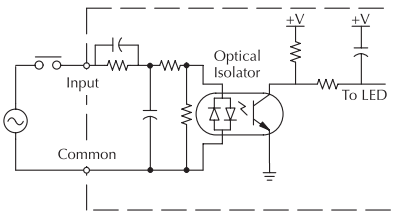
D0-05AD Specifications		
AC Power Supply Specifications	Voltage Range	95-240VAC (30VA)
AC Input Specifications	Number of Input Pts.	8
	Number of Commons	2 (isolated)
	Input Voltage Range	90-120VAC
	Frequency Range	47-63Hz
	Input Current	8mA @ 100 VAC at 50 Hz 10mA @ 100 VAC at 60Hz
	On Current/ Voltage Level	>6mA/75VAC
	OFF Current/ Voltage Level	<2mA/20VAC
	OFF to ON Response	<40ms
	ON to OFF Response	<40ms
	Fuses	None
DC Output Specifications	Number of Output Points	6 (sinking)
	Number of Commons	1
	Output Voltage Range	6-27VDC
	Peak Voltage	50VDC
	Max. Frequency (Y0, Y1)	7kHz
	ON Voltage Drop	0.5VDC @ 1A
	Maximum Current	0.5A/pt (Y0-Y1)* 1.0A pt (Y2-Y5)
	Maximum Leakage Current	15µA @ 30VDC
	Maximum Inrush Current	2A for 100ms
	OFF to ON Response	<10µs
	ON to OFF Response	<30µs (Y0-Y1) <60µs (Y2-Y5)
	External DC Power Required	20-28VDC 150mA max
	Status Indicators	Logic side
	Fuses	None (external recommended)

*When output points Y0 and Y1 are not used in pulse mode, the maximum output current is 1.0A

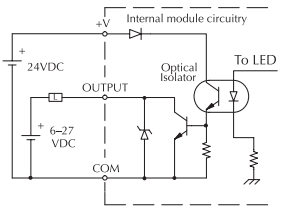


Power input wiring | Input point wiring | Output point wiring

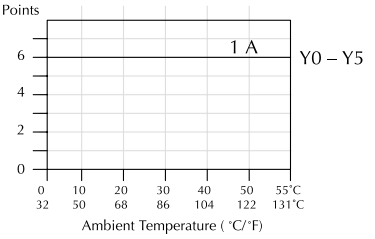
Equivalent input circuit



Equivalent output circuit



Derating chart for DC outputs



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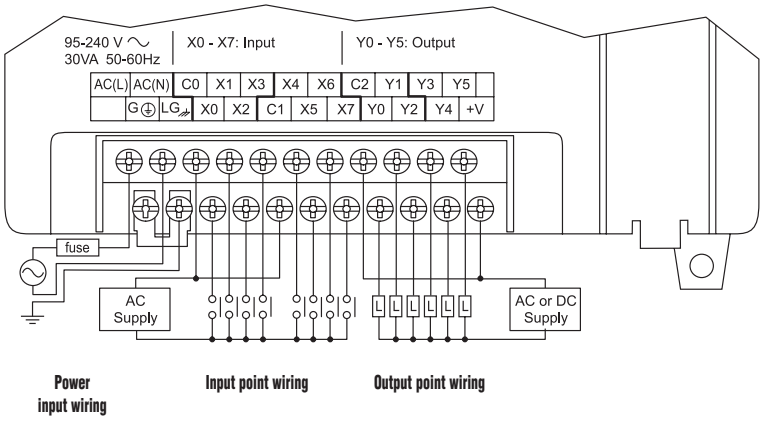
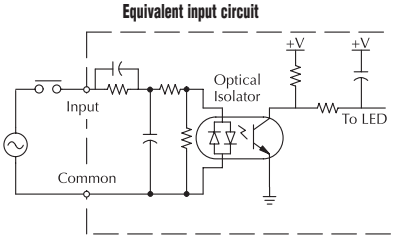
DL05 I/O Specifications

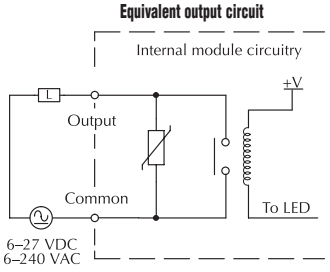
D0-05AR

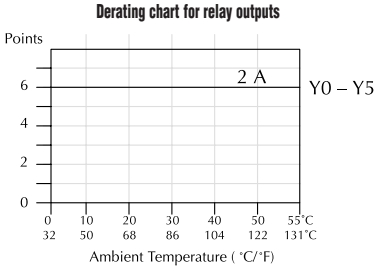
Wiring diagram and specifications

D0-05AR Specifications		
AC Power Supply Specifications	***Voltage Range***	95-240VAC (30VA)
AC Input Specifications	***Number of Input PTs.***	8
	Number of Commons	2 (isolated)
	Input Voltage Range	90-120VAC
	Frequency Range	47-63Hz
	Input Current	8mA @ 100VAC at 50Hz 10mA @ 100VAC at 60Hz
	On Current/Voltage Level	>6mA/75VAC
	OFF Current/ Voltage Level	<2mA/20VAC
	OFF to ON Response	<40ms
	ON to OFF Response	<40ms
	Fuses	None
Relay Output Specifications	***Number of Output Points***	6
	Number of Commons	2 (isolated)
	Output Voltage Range	6-240VAC, 47-63Hz 6-27VDC
	Maximum Voltage	264VAC,30VDC
	Maximum Current	2A/point 6A/common
	Maximum Leakage Current	0.1mA @ 246VAC
	Smallest Recommended Load	5mA @ 5VDC
	OFF to ON Response	<15ms
	ON to OFF Response	<10ms
	Status Indicators	Logic side
	Fuses	None (external recommended)


95-240 V ~
30VA 50-60Hz
X0 - X7: Input
Y0 - Y5: Output
AC(L) AC(N) C0 X1 X3 X4 X6 C2 Y1 Y3 Y5
G LG X0 X2 C1 X5 X7 Y0 Y2 Y4 +V
fuse
AC Supply
AC or DC Supply
Power input wiring
Input point wiring
Output point wiring







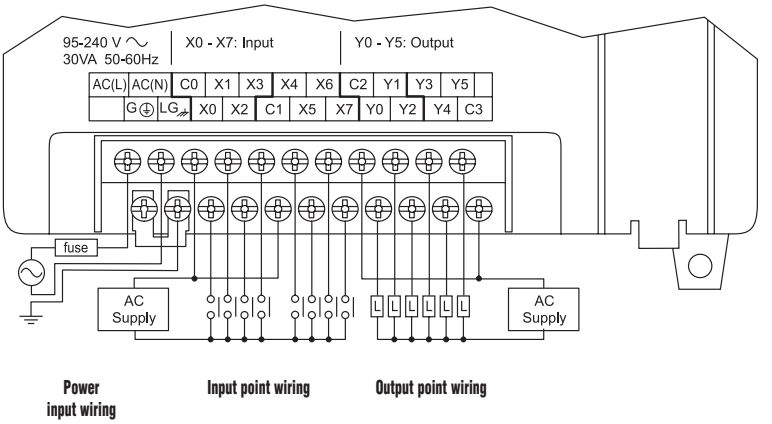
Typical Relay Life (Operations) at Room Temperature		
Voltage and Type of Load	***Load Current 1A***	***2A***
24 VDC Resistive	600K	270K
24 VDC Solenoid	150K	60K
110 VAC Resistive	900K	350K
110 VAC Solenoid	350K	150K
220 VAC Resistive	600K	250K
220 VAC Solenoid	200K	100K

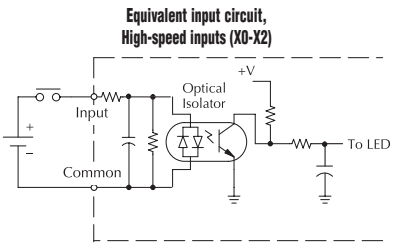
DL05 I/O Specifications

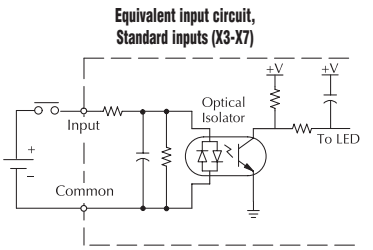
D0-05DA

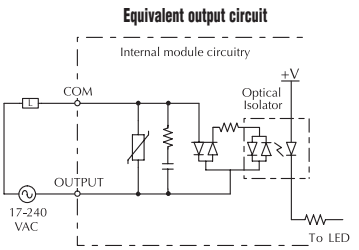
Wiring diagram and specifications

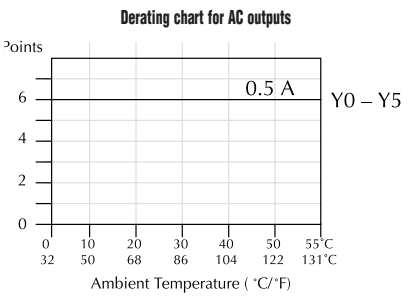
D0-05DA Specifications			
AC Power Supply Specifications	Voltage Range	95-240VAC (30VA)	
DC Input Specifications	Number of Input Pts.	8 (sink/source)	
	Number of Commons	2 (isolated)	
	Input Voltage Range	12-24VDC	
	Input Impedance	(X0-X2) 1.8K @ 12-24VDC (X3-X7) 2.8K @ 12-24VDC	
	Frequency Range	47-63Hz	
	Input Current	8mA @ 100VAC at 50Hz 10mA @ 100VAC at 60Hz	
	On Current/Voltage Level	>5mA/10VDC	
	OFF Current/ Voltage Level	<0.5mA/<2VDC	
	Response Time	X0-X2	X3-X7
	OFF to ON Response	<100µs	<8ms
	ON to OFF Response	<100µs	<8ms
	Fuses	None	
AC Output Specifications	Number of Output Points	6	
	Number of Commons	2 (isolated)	
	Output Voltage Range	17-240VAC 47-63Hz	
	Peak Voltage	264VAC	
	ON Voltage Drop	1.5VAC>50mA 4.0VAC<50mA	
	Maximum Current	0.5A / point	
	Maximum Leakage Current	4mA @ 264VAC	
	Maximum Inrush Current	10A for 10ms	
	Minimum Load	10mA	
	OFF to ON Response	1ms	
	ON to OFF Response	1ms + 1/2 cycle	
	Fuses	None (external recommended)	


95-240 V ~
30VA 50-60Hz
X0 - X7: Input
Y0 - Y5: Output
AC(L) AC(N) C0 X1 X3 X4 X6 C2 Y1 Y3 Y5
G LG X0 X2 C1 X5 X7 Y0 Y2 Y4 C3
fuse
AC Supply
AC Supply
Power input wiring
Input point wiring
Output point wiring









1-800-633-0405

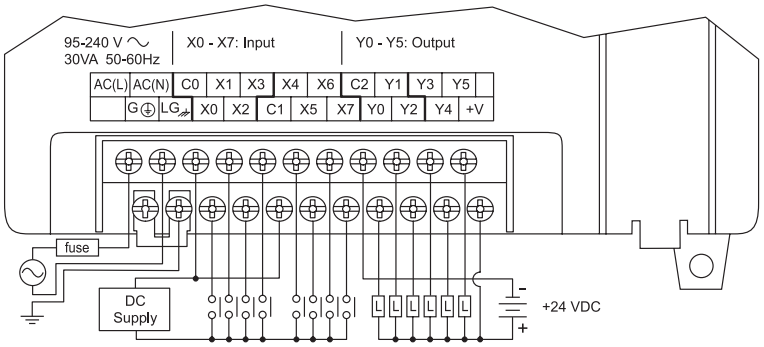
DL05 I/O Specifications

D0-05DD

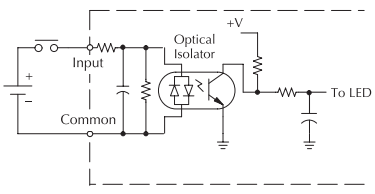
Wiring diagram and specifications

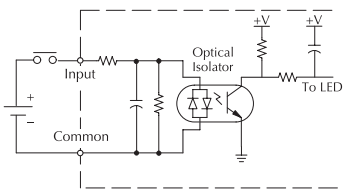
D0-05DD Specifications			
AC Power Supply Specifications	Voltage Range	95-240VAC (30VA)	
DC Input Specifications	Number of Input Pts.	8 (sink/source)	
	Number of Commons	2 (isolated)	
	Input Voltage Range	12-24VDC	
	Input Impedance	(X0-X2) 1.8K @ 12-24VDC (X3-X7) 2.8K @ 12-24VDC	
	On Current/ Voltage Level	>5mA/10VDC	
	OFF Current/ Voltage Level	<0.5mA/<2VDC	
	Response Time	X0-X2	X3-X7
	OFF to ON Response	<100µs	<8ms
	ON to OFF Response	<100µs	<8ms
	Fuses	None	
DC Output Specifications	Number of Output Points	6 (sinking)	
	Number of Commons	1	
	Output Voltage Range	6-27VDC	
	Peak Voltage	50VDC	
	Max. Frequency (Y0, Y1)	7kHz	
	ON Voltage Drop	0.5VDC @ 1A	
	Maximum Current	0.5A / point (Y0-Y1)* 1.0A point (Y2-Y5)	
	Maximum Leakage Current	15µ @ 30VDC	
	Maximum Inrush Current	2A for 100ms	
	OFF to ON Response	<10µ	
	ON to OFF Response	<30µs (Y0-Y1) <60µs (Y2-Y5)	
	External DC Power Required	20-28VDC 150mA max.	
	Status Indicators	Logic side	
	Fuses	None (external recommended)	

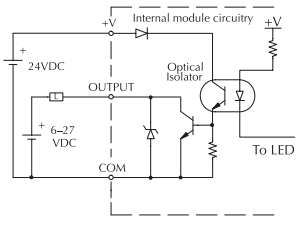
When output points Y0 and Y1 are not used in pulse mode, the maximum output current is 1.0A

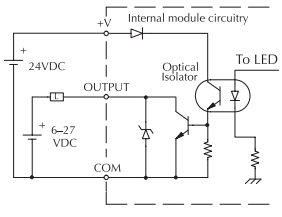


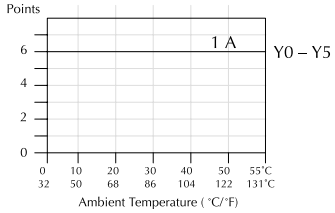
Power input wiring | Input point wiring | Output point wiring









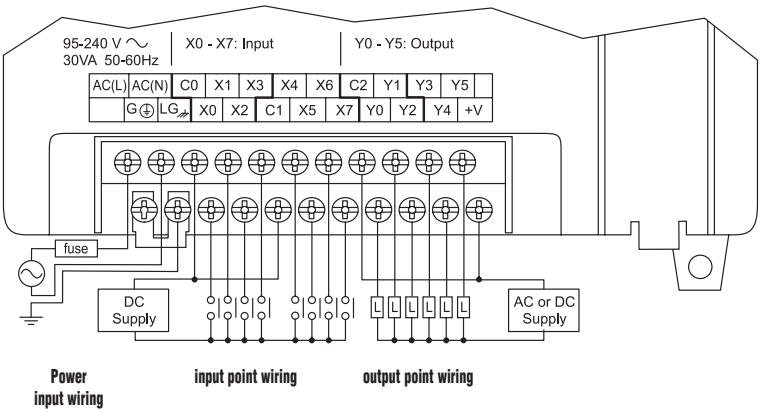


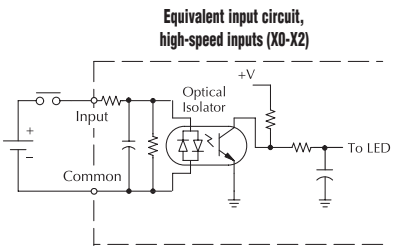
DL05 I/O Specifications

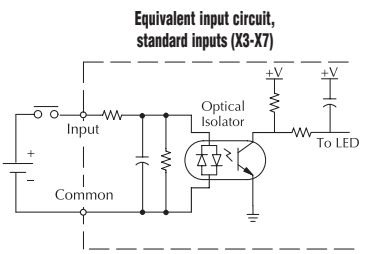
D0-05DR

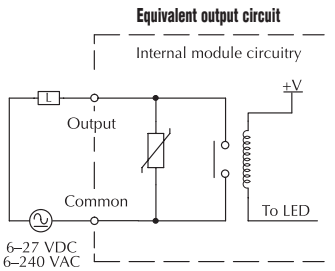
Wiring diagram and specifications

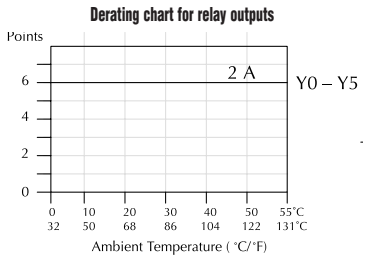
D0-05DR Specifications			
AC Power Supply Specifications	Voltage Range	95-240VAC (30VA)	
DC Input Specifications	Number of Input Pts.	8 (sink/source)	
	Number of Commons	2 (isolated)	
	Input Voltage Range	12-24VDC	
	Input Impedance	(X0-X2) 1.8K @ 12-24VDC (X3-X7) 2.8K @ 12-24VDC	
	On Current/ Voltage Level	>5mA/10VDC	
	OFF Current/ Voltage Level	<0.5mA/<2VDC	
	Response Time	X0-X2	X3-X7
	OFF to ON Response	<100µs	<8ms
	ON to OFF Response	<100µs	<8ms
	Fuses	None	
Relay Output Specifications	Number of Output Points	6	
	Number of Commons	2 (isolated)	
	Output Voltage Range	6-240VAC 47-63Hz 6-27VDC	
	Maximum Voltage	264VAC, 30VDC	
	Maximum Output Current	2A/point, 6A/common	
	Max. Leakage Current	0.1mA @ 264VAC	
	Smallest Recommended Load	5mA @ 5VDC	
	OFF to ON Response	<15ms	
	ON to OFF Response	<10ms	
	Status Indicators	Logic side	
	Fuses	None (external recommended)	











Typical Relay Life (Operations) at Room Temperature		
Voltage and Type of Load	Load Current 1A	2A
24 VDC Resistive	600K	270K
24 VDC Solenoid	150K	60K
110 VAC Resistive	900K	350K
110 VAC Solenoid	350K	150K
220 VAC Resistive	600K	250K
220 VAC Solenoid	200K	100K

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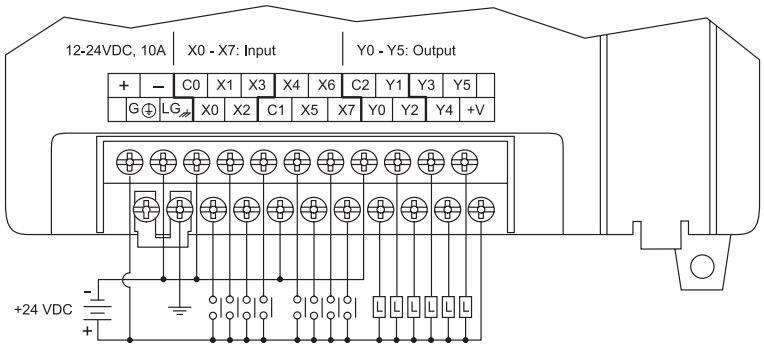
DL05 I/O Specifications

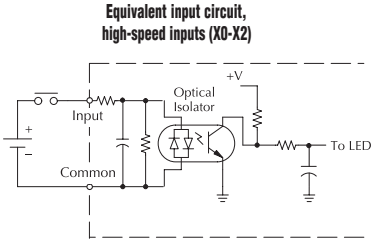
D0-05DD-D

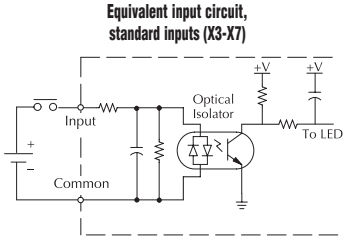
Wiring diagram and specifications

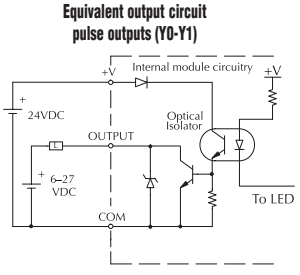
D0-05DD-D Specifications			
DC Power Supply Specifications	Voltage Range	12-24VDC 20W max.	
DC Input Specifications	Number of Input Pts.	8 (sink/source)	
	Number of Commons	2 (isolated)	
	Input Voltage Range	12-24VDC	
	Input Impedance	(X0-X2) 1.8K @ 12-24VDC (X3-X7) 2.8K @ 12-24VDC	
	On Current/ Voltage Level	>5mA/10VDC	
	OFF Current/ Voltage Level	<0.5mA/<2VDC	
	Response Time	X0-X2	X3-X7
	OFF to ON Response	<100µs	<8ms
	ON to OFF Response	<100µs	<8ms
	Fuses	None	
DC Output Specifications	Number of Output Points	6 (sinking)	
	Number of Commons	1 (isolated)	
	Output Voltage Range	6-27VDC	
	Peak Voltage	50VDC	
	Max. Frequency (Y0, Y1)	7kHz	
	On Voltage Drop	0.5VDC @ 1A	
	Maximum Current	0.5A/point (Y0-Y1)* 1.0A point (Y2 Y5)	
	Max. Leakage Current	15µ @ 30VDC	
	Maximum Inrush Current	2A for 100ms	
	OFF to ON Response	<10µ	
	ON to OFF Response	<30µs (Y0-Y1) <60µs (Y2-Y5)	
	External DC Power Required	20-28VDC 150mA max.	
	Status Indicators	Logic side	
	Fuses	None (external recommended)	

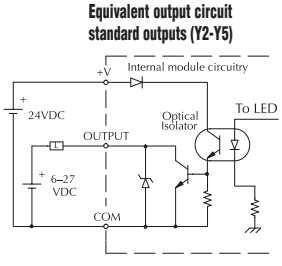
*When output points Y0 and Y1 are not used in pulse mode, the maximum output current is 1.0A

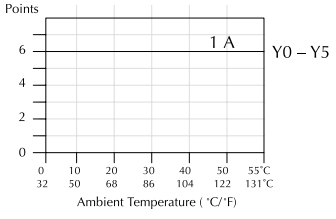

12-24VDC, 10A
X0 - X7: Input
Y0 - Y5: Output
+ – C0 X1 X3 X4 X6 C2 Y1 Y3 Y5
G LG X0 X2 C1 X5 X7 Y0 Y2 Y4 +V
+24 VDC
Power input wiring
Input point wiring
Output point wiring









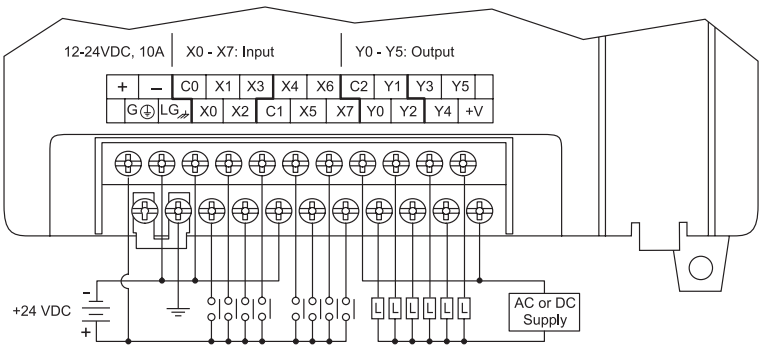


DL05 I/O Specifications

D0-05DR-D

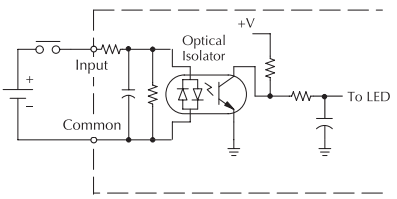
Wiring diagram and specifications

D0-05DR-D Specifications			
DC Power Supply Specifications	Voltage Range	12-24VDC 20W max.	
DC Input Specifications	Number of Input Pts.	8 (sink/source)	
	Number of Commons	2 (isolated)	
	Input Voltage Range	12-24VDC	
	Input Impedance	(X0-X2) 1.8K @ 12-24VDC (X3-X7) 2.8K @ 12-24VDC	
	On Current/ Voltage Level	>5mA/10VDC	
	OFF Current/ Voltage Level	<0.5mA/<2VDC	
	Response Time	X0-X3	X4-X7
	OFF to ON Response	<100µ	<8ms
	ON to OFF Response	<100µs	<8ms
	Fuses	None	
Relay Output Specifications	Number of Output Points	6	
	Number of Commons	2 (isolated)	
	Output Voltage Range	6-240VAC, 47-63Hz 6-27VDC	
	Maximum Voltage	264VAC, 30VDC	
	Maximum Output Current	2A/point, 6A/common	
	Max.Leakage Current	0.1mA @ 264VAC	
	Smallest Recommended Load	5mA @ 5VDC	
	OFF to ON Response	<15ms	
	ON to OFF Response	<10ms	
	Status Indicators	Logic side	
	Fuses	None (external recommended)	

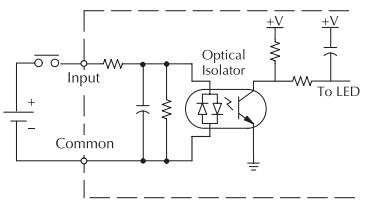


Power input wiring | Input point wiring | Output point wiring

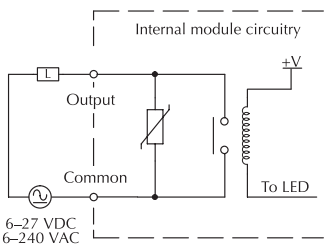
Equivalent input circuit, high-speed inputs (X0-X2)



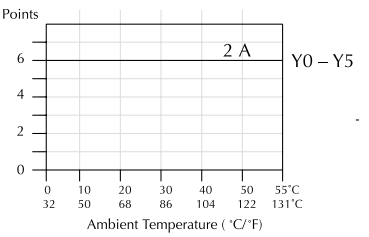
Equivalent input circuit, standard inputs (X3-X7)



Equivalent output circuit



Derating chart for relay outputs



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DL05/06 Option Modules

Need to expand your DL05 or DL06?

Customize your DL05 or DL06 PLC to fit your application by adding option cards in the built-in slots. We offer discrete and analog I/O for the DL05 or DL06, a memory and clock card for the DL05 (see below), and a DeviceNET card for either the DL05 or the DL06. You can add these features without adding size.

D0-01MC (DL05 only)

DL05 flash memory

The standard DL05 PLC uses non-volatile flash memory to back-up the user program. Program data (V-memory) is backed by a super capacitor. If you need longer retention of program data, we recommend the D0-01MC. We also recommend the D0-01MC for applications that require transferring programs without a programming device or that require a real-time clock.

Simple and inexpensive

The D0-01MC slides easily into the option card slot in any DL05 PLC to back up PLC programs and data for extended periods of time.

Battery-backed RAM

The memory cartridge makes programs portable from one DL05 PLC to another. The memory map is identical to the internal memory in the DL05 PLC, so no program changes are necessary.

The on-board lithium battery lasts up to three years. If PLC power is lost and the battery is already dead, an on-board super capacitor backs up the memory four to seven days, allowing time to insert a new battery.

Real-time clock

Access the year, month, day of the week, hour, minute and second for event scheduling or data logging applications.

Operation

The D0-01MC installs into any of the DL05 PLCs. The MC module backs up all ladder and data in CMOS RAM.

The module's V-memory maps one-for-one to the PLC's memory locations. If the memory cartridge is inserted in the option slot, it automatically becomes the source of the controlling program.

You may choose to overwrite the PLC program, but it is not necessary. You can transfer the program from the PLC to the module, or from the module to the PLC, or you can operate directly from the memory cartridge. By removing the module, you return control to the PLC's internal program.

Two pushbuttons on the face of the module initiate memory transfers. The pushbuttons are clearly marked to indicate the direction of the transfer, and an LED flashes to confirm the direction and success of the memory transfer.

A jumper enables/disables the write function in the D0-01MC. Write disable prevents overwriting of the module's memory. Write enable allows overwriting of the module's memory.

An LED alerts you to a low battery condition. If the battery drops below 2.5V the "BATT" LED comes on, and an internal bit is set. You can use the internal bit to activate alarm functions or to execute an orderly shutdown.

The date and time are easily set or accessed in the ladder logic program. Environmental specifications for the D0-01MC are the same as for the DL05 PLCs.

DL05/06 Specialty Option Modules

D0-DEVNETS

The D0-DEVNETS option card transforms any DL05 or DL06 into a smart device node on your DeviceNet controller network. Now you don't have to turn to a more expensive PLC to get DeviceNet capability.

DeviceNet is a low-cost control bus used to connect field devices to PLCs and PCs. DeviceNet is designed to reduce the need for hard-wiring while providing device-level diagnostics. This industrial protocol links up to 64 nodes on a single network.

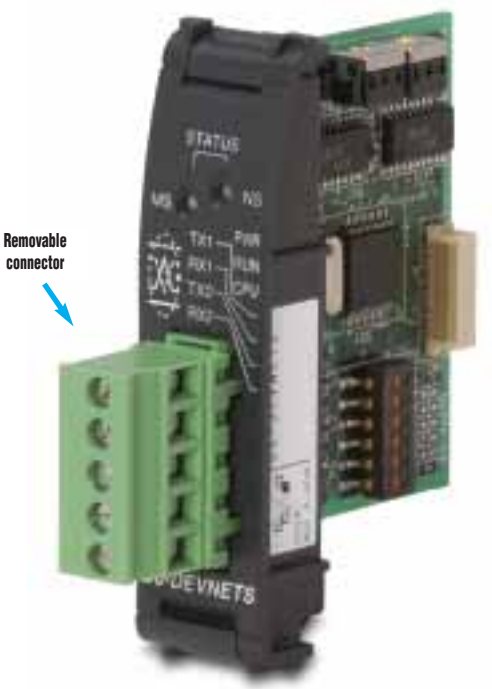
The D0-DEVNETS slave module slides into the option card slot of any DL05 or DL06 PLC. The module collects and reports all discrete I/O data to a DeviceNet master.

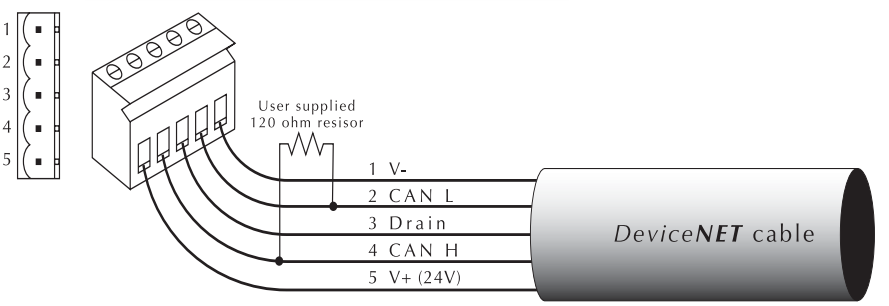
The D0-DEVNETS module has a removable connector that makes the four-wire connection easy to implement and maintain. The DeviceNet module incorporates advanced diagnostics not commonly found on traditional industrial networks. This module has the quick response time and high dependability expected from any DeviceNet device.

General Specifications	
DeviceNet Compatibility	Predefined Group 2 Master/Slave communications
Maximum Field Devices per Bus	64 (see table below)
Communication to Field Devices	Standard 4-wire shielded cable to cabinet connector, molded 4-wire cable @ up to 500Kbps to field devices
Module Connector	5-position removable terminal (European style)
Operating Temperature	0 to 55°C (32 to 131° F)
Storage Temperature	20 to 70°C (-4 to 158° F)
Relative Humidity	5 to 95% (non-condensing)
Environmental Air	No corrosive gases permitted
Vibration	MIL STD 810C 514.2
Shock	MIL STD 810C 516.2
Noise Immunity	Impulse noise 1μs, 1000V FCC class A RFI (144Mhz, 430Mhz 10W, 10cm)

Trunk Length		Bits per sec	Branch Length		Devices
Feet	*Meters*		*Feet*	*Meters*	
328ft	100m	500Kbps	20ft	6m	64
820ft	250m	250Kbps	20ft	6m	64
1,640ft	500m	125Kbps	20ft	6m	64

Other DeviceNet specifications, compatible products, and latest DeviceNet information are made available through:
Open DeviceNet Vendor Association
Phone: (954) 340-5412 Fax: (954) 340-5413
Internet Address: http://www.odva.org
e-mail: odva@powerinternet.com
ODVA, Inc.
20423 State Road 7
Boca Raton, FL 33498





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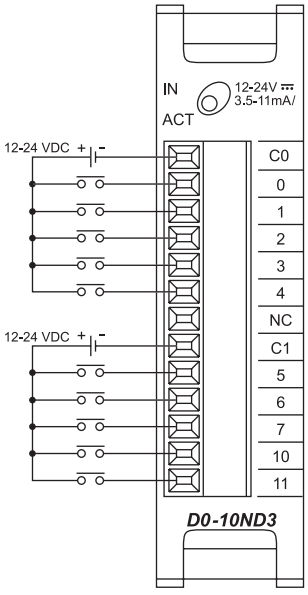
DL05/06 I/O Option Modules

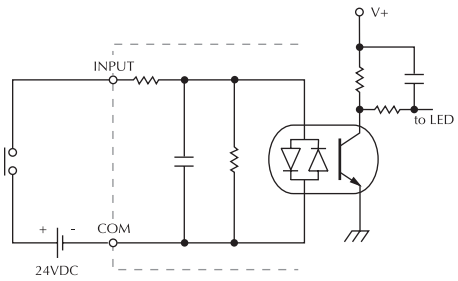
D0-10ND3

10-point DC input module

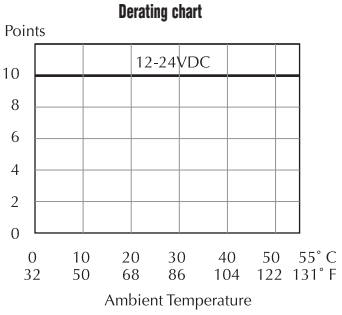
D0-10ND3 Input Specifications	
Number of Inputs	10 (sink/source)
Input Voltage Range	10.8-26.4VDC
Operating Voltage Range	12-24VDC
Peak Voltage	30.0VDC
Input Current	Typical: 4.0mA @ 12VDC 8.5mA @ 24VDC
Maximum Input Current	11mA @ 26.4VDC
Input Impedance	2.8KΩ @ 12-24VDC
On Voltage Level	> 10.0 VDC
Off Voltage Level	< 2.0 VDC
Minimum ON Current	3.5mA
Minimum OFF Current	0.5mA
Off to on Response	2-8ms, Typ. 4ms
On to off Response	2-8ms, Typ. 4ms
Status Indicators	Module activity: one green LED
Commons	2 non-isolated
Fuse	No fuse
Base Power Required (5V)	Typical. 35mA (all pts. on)



Equivalent input circuit



Derating chart

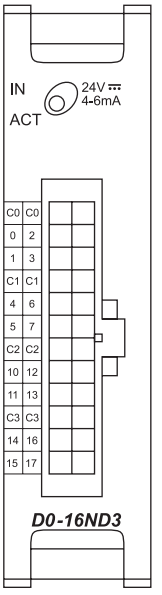


DL05/06 I/O Option Modules

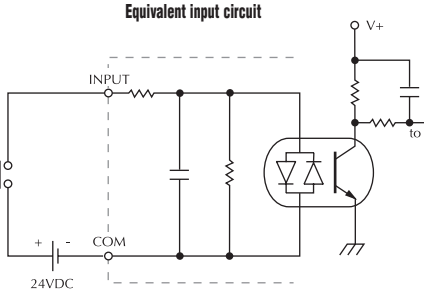
D0-16ND3

16-point DC input module

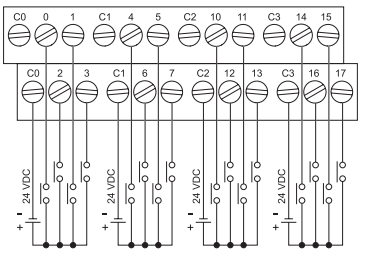
D0-16ND3 Input Specifications	
Number of Inputs	16 (sink/source)
Input Voltage Range	20-28VDC
Operating Voltage Range	24VDC
Peak Voltage	30.0VDC
Input Current	Typical: 4.0mA @ 24VDC
Maximum Input Current	6mA @ 28VDC
Input Impedance	4.7KΩ @ 24VDC
On Voltage Level	> 19.0 VDC
Off Voltage Level	< 7.0 VDC
Minimum ON Current	3.5mA
Minimum OFF Current	1.5mA
Off to on Response	2-8ms, Typ. 4ms
On to off Response	2-8ms, Typ. 4ms
Status Indicators	Module activity: one green LED
Commons	4 non-isolated
Fuse	No fuse
Base Power Required (5V)	Typical. 35mA (all pts. on)



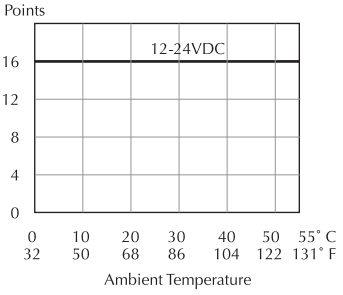
Equivalent input circuit

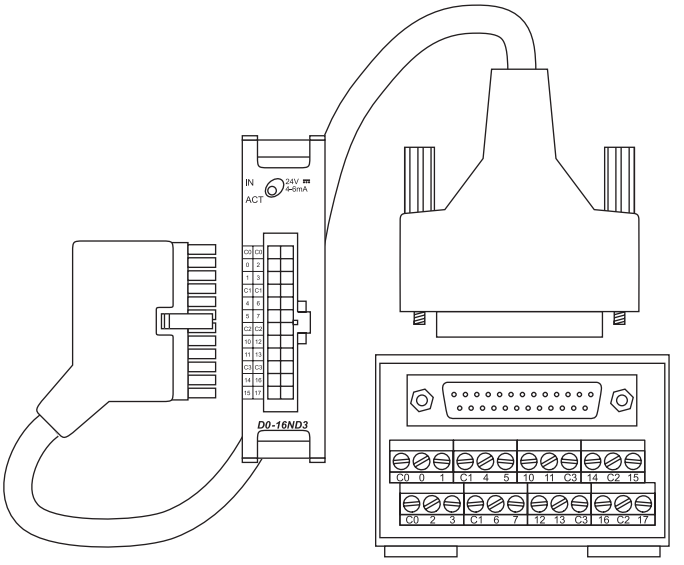


Wiring for ZL-056CM



Derating chart





Use ZipLink ZL-CBL056 cable and ZL-CM056 connector module or build your own cables using 24-pin Molex Micro Fit 3.0 receptacle, part number 43025, or compatible.

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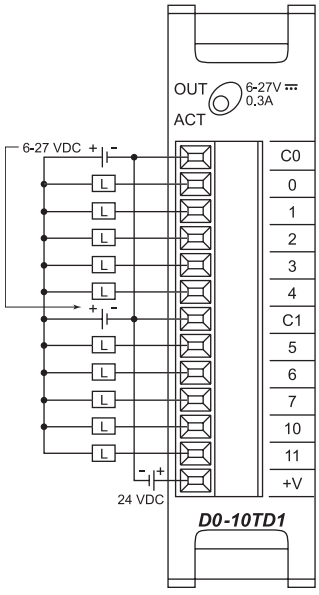
DL05/06 I/O Option Modules

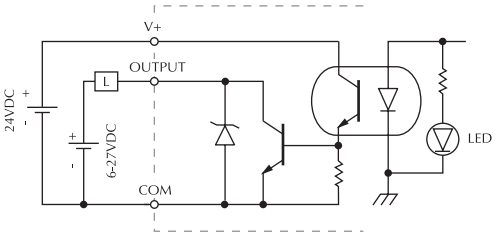
D0-10TD1

10-point DC output module

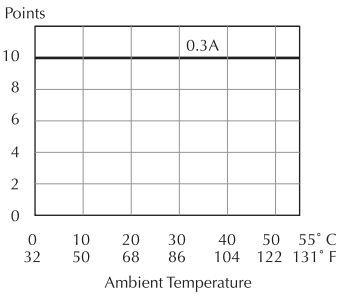
D0-10TD1 Output Specifications	
Number of Outputs	10 (sinking)
Operating Voltage Range	6-27VDC
Output Voltage Range	5-30VDC
Peak Voltage	50.0VDC
Maximum Output Current	0.3A/point, 1.5A/common
Minimum Output Current	0.5mA
Maximum Leakage Current	15μA @ 30.0VDC
On Voltage Drop	0.5VDC @ 0.3A
Maximum Inrush Current	1A for 10ms
Off to On Response	< 10μs
On to Off Response	< 60μs
Status Indicators	Module activity: one green LED
Commons	2 non-isolated (5 points/common)
Fuse	No fuse
External DC Power Required	20-28VDC max 200mA (all pts. on)
Base Power Required (5V)	Max. 150mA (all pts. on)



Equivalent output circuit



Derating chart

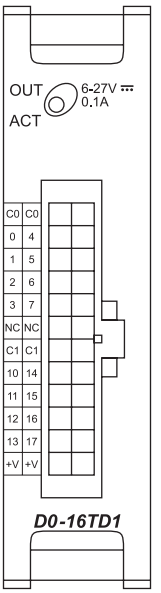


DL05/06 I/O Option Modules

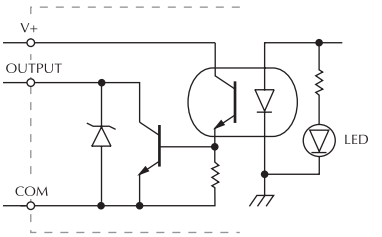
D0-16TD1

16-point DC output module

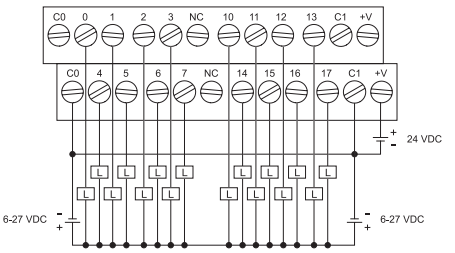
D0-16TD1 Output Specifications	
Number of Outputs	16 (sinking)
Operating Voltage Range	6-27VDC
Output Voltage Range	5-30VDC
Peak Voltage	50.0VDC
Maximum Output Current	0.1A/point, 0.8A/common
Minimum Output Current	0.5mA
Maximum Leakage Current	15μA @ 30.0VDC
On Voltage Drop	0.5VDC @ 0.1A
Maximum Inrush Current	1A for 10ms
Off to On Response	< 0.5ms
On to Off Response	< 0.5ms
Status Indicators	Module activity: one green LED
Commons	2 isolated (8 points/common)
Fuse	No fuse
External DC Power Required	20-28VDC max 70mA (all pts. on)
Base Power Required (5V)	Max. 200mA (all pts. on)



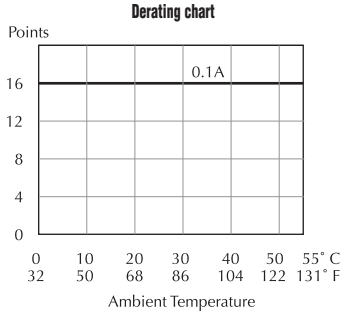
Equivalent output circuit

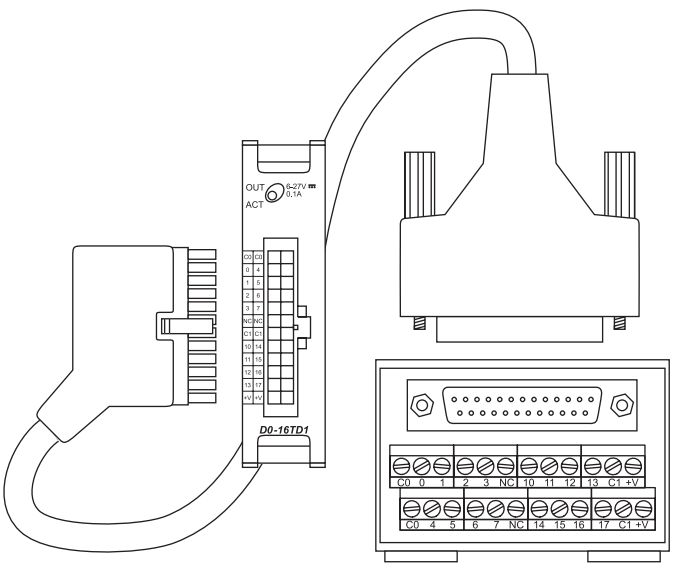


Wiring for ZL-056CM



Derating chart





Use ZipLink ZL-CBL056 cable and ZL-CM056 connector module or build your own cables using 24-pin Molex Micro Fit 3.0 receptacle, part number 43025, or compatible.

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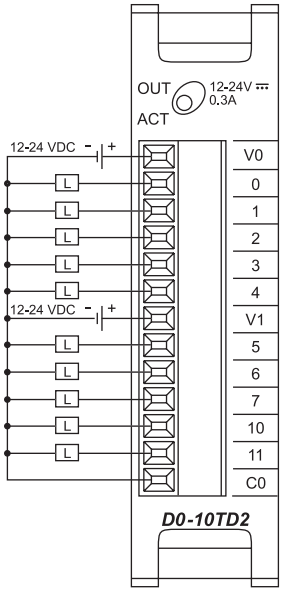
DL05/06 I/O Option Modules

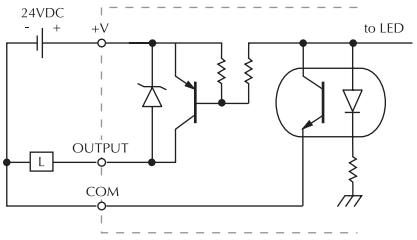
D0-10TD2

10-point DC output module

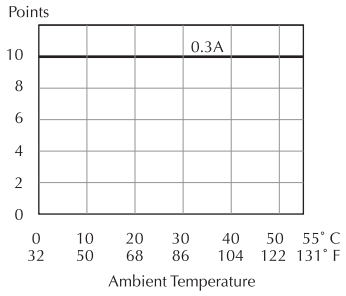
D0-10TD2 Output Specifications	
Number of Outputs	10 (sourcing)
Operating Voltage Range	12-24VDC
Output Voltage Range	10.8-26.4VDC
Peak Voltage	50.0VDC
Maximum Output Current	0.3A/point, 1.5A/common
Minimum Output Current	0.5mA
Maximum Leakage Current	1.5μA @ 26.4VDC
On Voltage Drop	1.0VDC @ 0.3A
Maximum Inrush Current	1A for 10ms
Off to On Response	< 10μs
On to Off Response	< 60μs
Status Indicators	Module activity: one green LED
Commons	2 non-isolated (5 points/common)
Fuse	No fuse
Base Power Required (5V)	Max. 150mA (all pts. on)



Equivalent output circuit



Derating chart

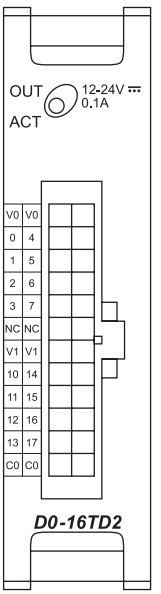


DL05/06 I/O Option Modules

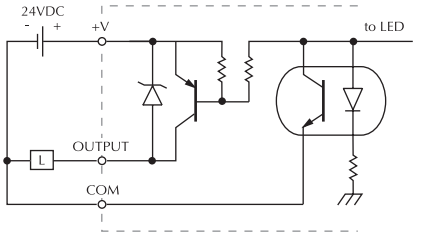
D0-16TD2

16-point DC output module

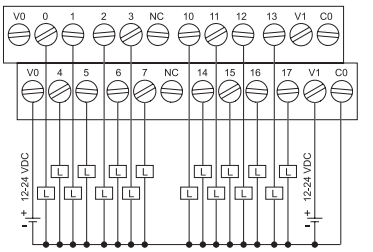
D0-16TD2 Output Specifications	
Number of Outputs	16 (sourcing)
Operating Voltage Range	12-24VDC
Output Voltage Range	10.8-26.4VDC
Peak Voltage	50.0VDC
Maximum Output Current	0.1A/point, 0.8A/common
Minimum Output Current	0.5mA
Maximum Leakage Current	1.5μA @ 26.4VDC
On Voltage Drop	1.0VDC @ 0.1A
Maximum Inrush Current	1A for 10ms
Off to On Response	< 0.5ms
On to Off Response	< 0.5ms
Status Indicators	Module activity: one green LED
Commons	2 non-isolated (8 points/common)
Fuse	No fuse
Base Power Required (5V)	Max. 200mA (all pts. on)



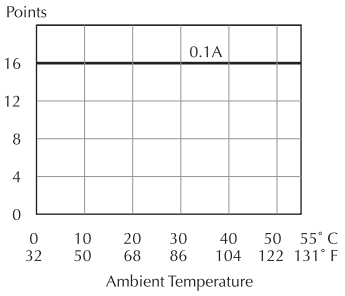
Equivalent output circuit

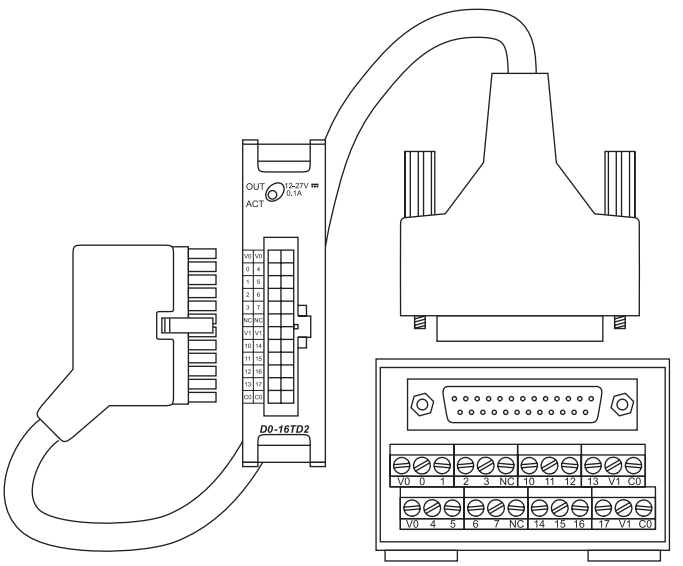


Wiring for ZL-056CM



Derating chart





Use ZipLink ZL-CBL056 cable and ZL-CM056 connector module or build your own cables using 24-pin Molex Micro Fit 3.0 receptacle, part number 43025, or compatible.

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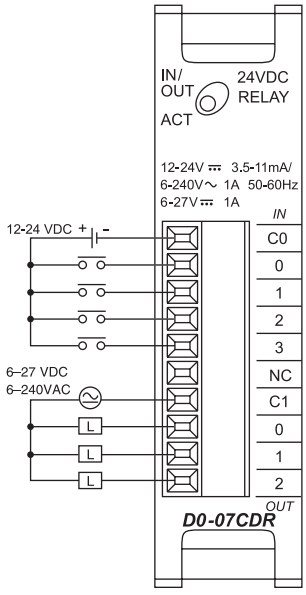
DL05/06 I/O Option Modules

D0-07CDR

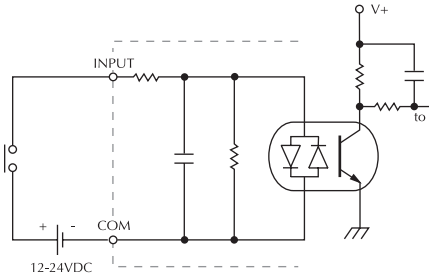
4-point DC input and 3-point relay output module

D0-07CDR Input Specifications	
Number of Inputs	4 (sink/source)
Operating Voltage Range	12-24VDC
Input Voltage Range	10.8-26.4VDC
Peak Voltage	30VDC
Maximum Input Current	11mA @ 26.4VDC
Input Current	Typical: 4mA @ 12VDC 8.5mA @ 24VDC
Input Impedance	2.8K @ 12-24VDC
ON Voltage Level	> 10.0VDC
OFF Voltage Level	< 2.0VDC
Minimum ON Current	3.5ms
Maximum OFF Current	0.5ms
ON to OFF Response	2-8ms, Typical 4ms
OFF to ON Response	2-8ms, Typical 4ms
Commons	1 (4 points/common)

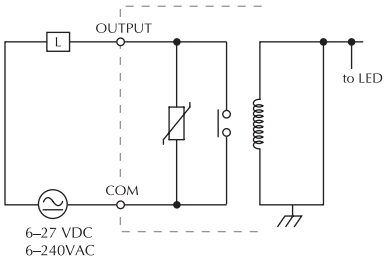
D0-07CDR Output Specifications	
Number of Outputs	3
Operating Voltage Range	6-27VDC/6-240VAC
Output Type	Relay, form A (SPST)
Peak Voltage	30.0VDC/264VAC
Maximum Current (resist.)	1A/point, 4A/common
Minimum Load Current	5mA @ 5VDC
Maximum Leakage Current	0.1mA @ 264VAC
On Voltage Drop	N/A
Maximum Inrush Current	Output: 3A for 10ms Common: 10A for 10ms
Off to On Response	< 15ms
On to Off Response	< 10ms
Status Indicators	Module activity: one green LED
Commons	1 (3 points/common)
Fuse	No fuse
Base Power Required (5V)	Max. 200mA (all pts. on)



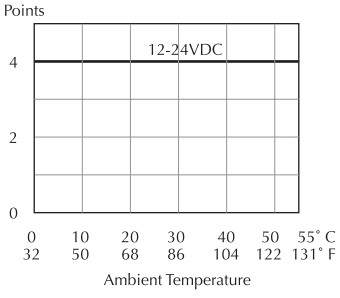
Equivalent input circuit



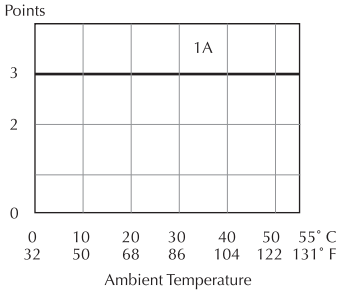
Equivalent output circuit



Derating chart for DC inputs



Derating chart for relay outputs

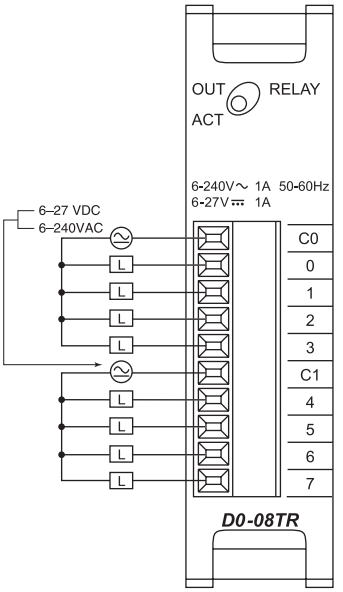


DL05/06 I/O Option Modules

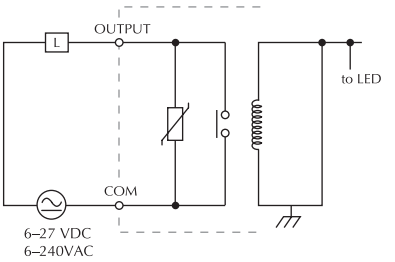
D0-08TR

8-point relay output module

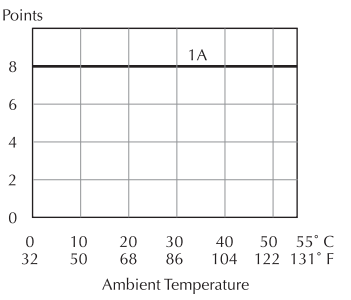
D0-08TR Output Specifications	
Number of Outputs	8
Operating Voltage Range	6-27VDC/6-240VAC
Output Type	Relay, form A (SPST)
Peak Voltage	30.0VDC/264VAC
Maximum Current (resist.)	1A/point, 4A/common
Minimum Load Current	0.5mA
Maximum Leakage Current	0.1mA @ 264VAC
On Voltage Drop	N/A
Maximum Inrush Current	Output: 3A for 10ms Common: 10A for 10ms
Off to On Response	< 15ms
On to Off Response	< 10ms
Status Indicators	Module activity: one green LED
Commons	2 isolated (4 points/common)
Fuse	No fuse
Base Power Required (5V)	Max. 280mA (all pts. on)



Equivalent output circuit



Derating chart



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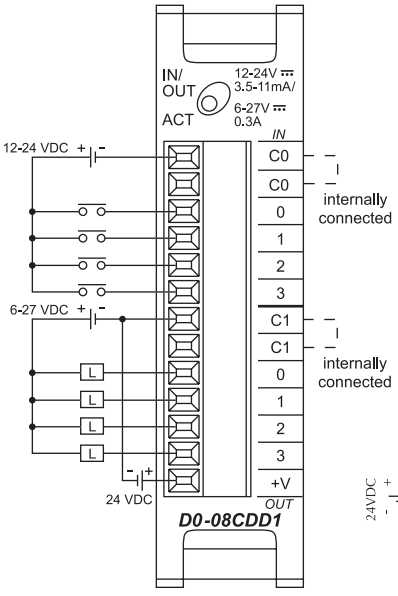
DL05/06 I/O Option Modules

D0-08CDD1

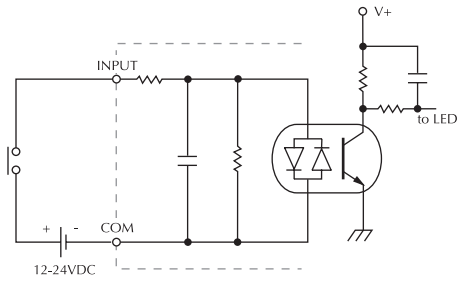
4-point DC input and 4-point DC output module

D0-08CDD1 Input Specifications	
Number of Inputs	4 (sink/source)
Operating Voltage Range	10.8-26.4VDC
Input Voltage Range	12-24VDC
Peak Voltage	30VDC
Maximum Input Current	11mA @ 26.4VDC
Input Current	Typical: 4mA @ 2VDC 8.5mA @ 24VDC
Input Impedance	2.8K @ 12-24VDC
ON Voltage Level	> 10.0VDC
OFF Voltage Level	< 2.0VDC
Minimum ON Current	3.5mA
Maximum OFF Current	0.5mA
OFF to ON Response	2-8ms, typical 4ms
ON to OFF Response	2-8ms, typical 4ms
Commons	2 non-isolated (2 points/common)

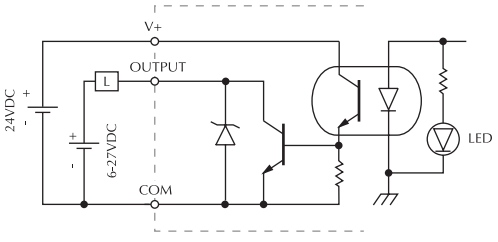
D0-08CDD1 Output Specifications	
Number of Outputs	4 (sinking)
Operating Voltage range	6-27VDC
Output voltage Range	5-30VDC
Peak Voltage	50.0VDC
Maximum Output Current	0.3A/point, 1.2A/common
Minimum Output Current	0.5mA
Maximum Leakage Current	1.5μA @ 30.0VDC
On Voltage Drop	0.5VDC @ 0.3A
Maximum Inrush Current	1A for 10ms
Off to On Response	< 10μs
On to Off Response	< 60μs
Status Indicators	Module activity: one green LED
Commons	2 non-isolated (2 points/common)
Fuse	No fuse
Base Power Required (5V)	Max. 200mA (all pts. on)
External DC Power Required (24V)	20-28VDC, max. 80mA (all pts. on)



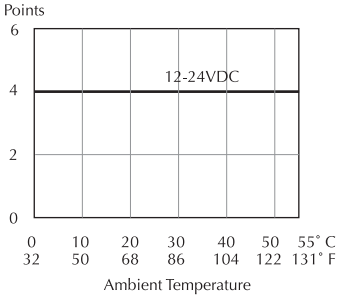
Equivalent input circuit



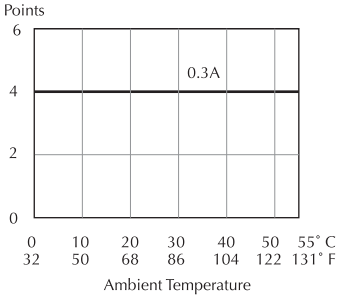
Equivalent output circuit



Derating chart for DC inputs



Derating chart for DC outputs



DL05/06 Option Modules

F0-04AD-1

4-point analog input module

Input Specifications	
Number of Channels	4, single ended (one common)
Input Range	0 to20mA or 4 to 20mA (jumper selectable)
Resolution	12 bit (1 in 4096)
Step Response	25.0mS (typ.) to 95% of full step change
Crosstalk	1/2 count max (-80db)*
Active Low-pass Filtering	-3dB at 40Hz (-12dB per octave)
Input Impedance	125Ω ±0.1%, 1/8 watt
Absolute Max Ratings	-30mA to +30mA, current input
Converter Type	Successive approximation
Linearity Error (end to end)	±2 counts
Input Stability	±1 count*
Full-scale Calibration Error	±10 counts max. @ 20mA*
Offset Calibration Error	±5 counts max. @ 4mA*
Max Inaccuracy	±0.4% at 25°C (77°F) ±0.85% at 0 to 60°C (32 to 140°F)
Accuracy vs. Temperature	±100 ppm/°C typical
Recommended Fuse	0.032A, series 217 fast-acting, current inputs

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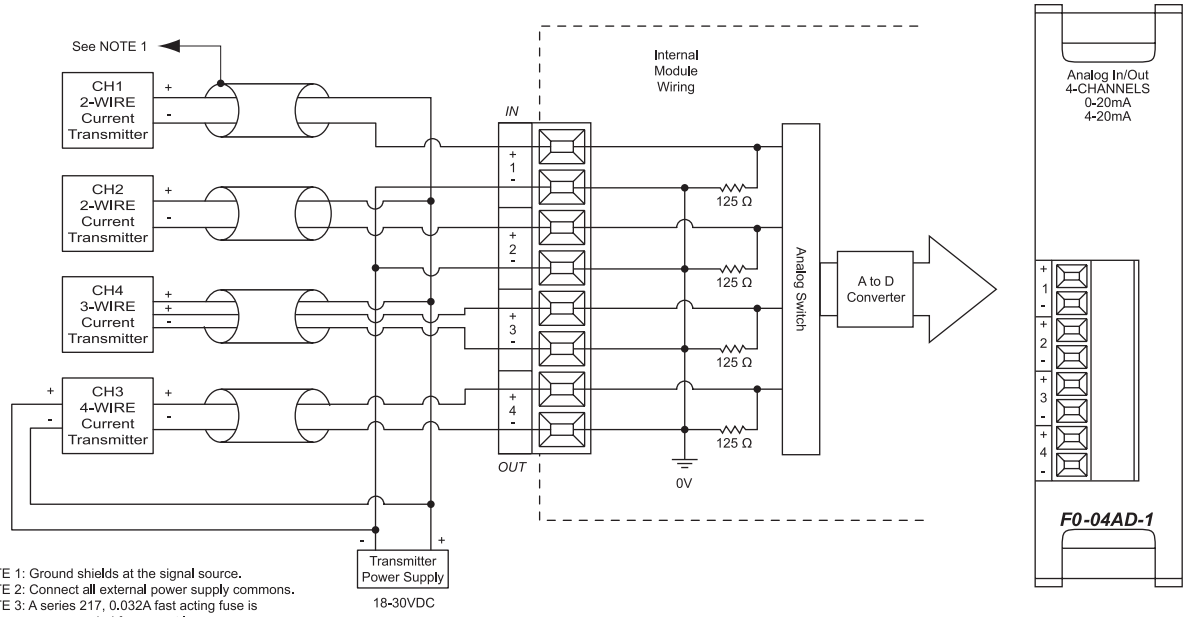


NOTE 1: Ground shields at the signal source.
NOTE 2: Connect all external power supply commons.
NOTE 3: A series 217, 0.032A fast acting fuse is recommended for current loops.

DL05/06 Option Modules

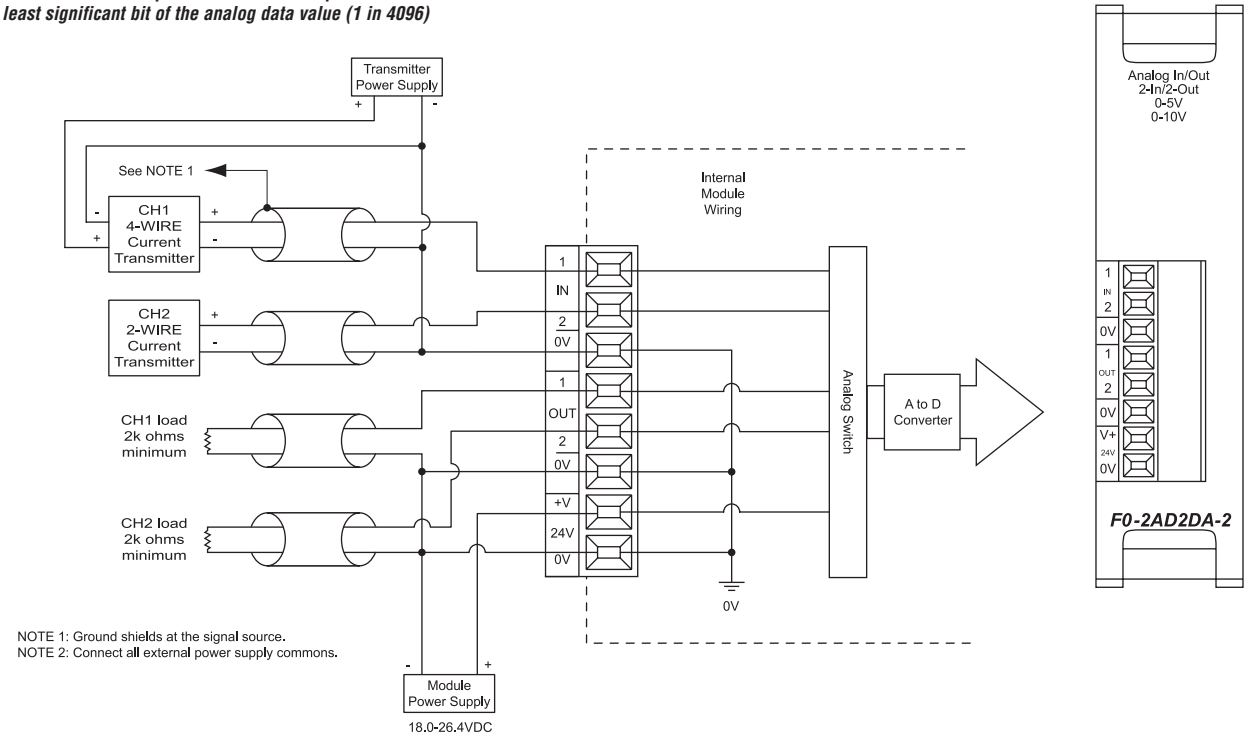
F0-2AD2DA-2

2-point analog input and 2-point analog output module

Input Specifications	
Number of Channels	2, single ended (one common)
Input Range	0 to 5VDC or 0 to 10VDC (jumper selectable)
Resolution	12 bit (1 in 4096)
Step Response	10.0mS to 95% of full step change
Crosstalk	1/2 count max (-80db)*
Active Low-pass Filtering	-3dB at 300Hz (-12dB per octave)
Input Impedance	>20KΩ
Absolute Max Ratings	±15V
Linearity Error (end to end)	±2 counts (0.025% of full scale) max*
Input Stability	±1 count*
Gain Error	±6 counts max*
Offset Error	±2 counts max*
Max Inaccuracy	±0.3% at 25°C (77°F) ±0.6% at 0 to 60°-C (32 to 140°F)
Accurracy vs. Temperature	±100 ppm/°C typical

Output Specifications	
Number of Channels	2, single ended (one common)
Output Range	0 to5VDC or 0 to 10VDC (jumper selectable)
Resolution	12 bit (1 in 4096)
Conversion Settling Time	50μS for full scale change
Crosstalk	1/2 count max (-80db)*
Peak Output Voltage	±15VDC (power supply limited)
Offset Error	0.1% of range
Gain Error	0.4% of range
Linearity Error (end to end)	±1 counts (0.075% of full scale) max*
Output Stability	±2 counts*
Load Impedance	2KΩ max
Load Capacitance	0.01μF max
Accurracy vs. Temperature	±50 ppm/°C typical

**** One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096)***



NOTE 1: Ground shields at the signal source.
NOTE 2: Connect all external power supply commons.

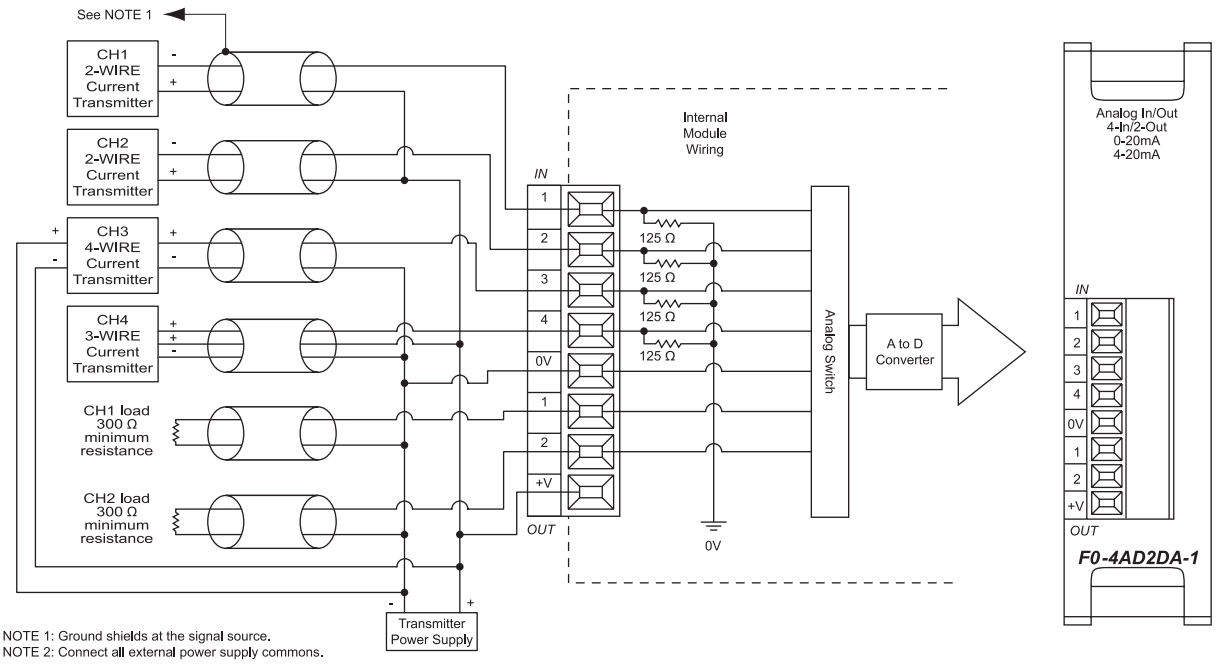
DL05/06 Option Modules

F0-4AD2DA-1

4-point analog input and
2-point analog output module

Input Specifications	
Number of Channels	4, single ended (one common)
Input Range	0 to20mA or 4 to 20mA (jumper selectable)
Resolution	12 bit (1 in 4096)
Step Response	25.0mS (typ.) to 95% of full step change
Crosstalk	1/2 count max (-80db)*
Active Low-pass Filtering	-3dB at 40Hz (-12dB per octave)
Input Impedance	125Ω ±0.1%, 1/8 watt
Absolute Max Ratings	-30mA to +30mA, current input
Converter Type	Successive approximation
Linearity Error (end to end)	±2 counts
Input Stability	±1 count*
Full-scale Calibration Error	±10 counts max. @ 20mA*
Offset Calibration Error	±5 counts max. @ 0mA*
Max Inaccuracy	±0.4% at 25°C (77°F) ±0.85% at 0 to 60°C (32 to 140°F)
Accurracy vs. Temperature	±100 ppm/°C typical
Recommended Fuse	0.032A, series 217 fast-acting, current inputs

Output Specifications	
Number of Channels	2, single ended (one common)
Output Range	0 to20mA or 4 to 20mA (jumper selectable)
Output Type	Current sourcing
Resolution	12 bit (1 in 4096)
Max. Loop Voltage	30VDC
Load/loop Power Supply	0-300Ω /18-30VDC
Linearity Error (end to end)	±2 counts (0.050% of full scale) max.*
Conversion Settling Time	400μs max. for full scale change
Full-scale Calibration Error	±26 counts max. @ 300Ω load ±18 counts max.. @ 250Ω load ±12 counts max.. @ 125Ω load
Offset Calibration Error	±10 counts max.. @ 300Ω load ±8 counts max.. @ 250Ω load ±6 counts max.. @ 125Ω load
Max.Full- scale Inaccuracy (all errors included)	300Ω load 0.4%. @ 60° C 250Ω load 0.3%. @ 60° C 125Ω load 0.2%. @ 60° C



NOTE 1: Ground shields at the signal source.
NOTE 2: Connect all external power supply commons.

1-800-633-0405

DL05/06 Option Modules

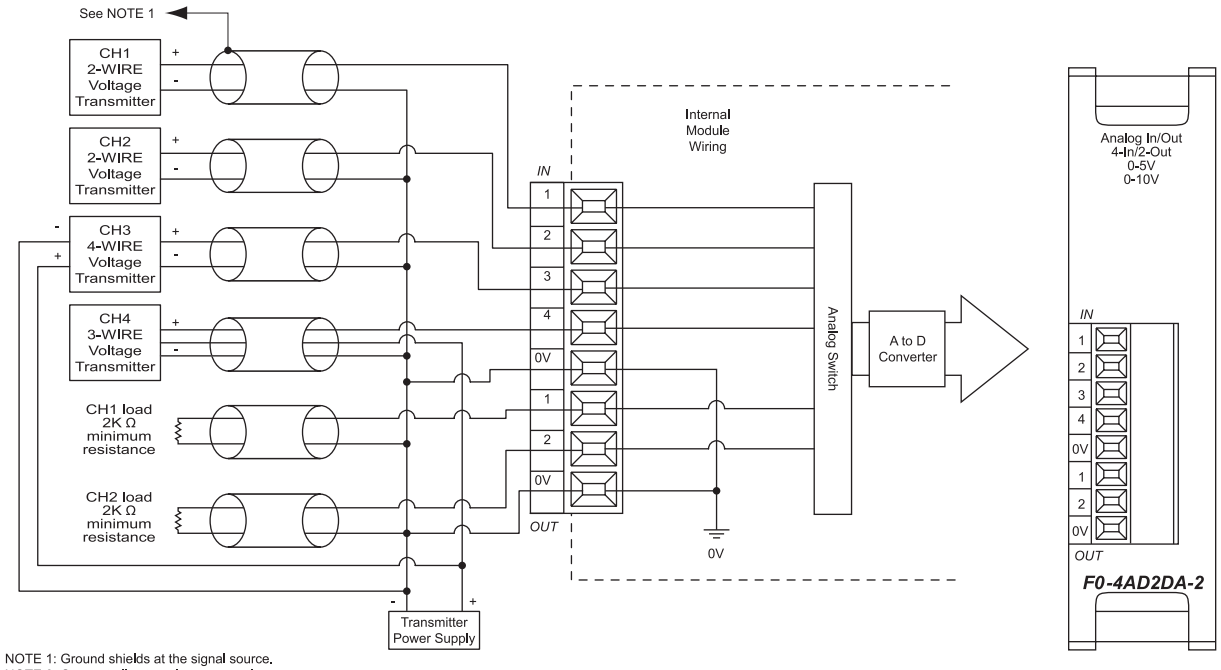
F0-4AD2DA-2

4-point analog input and 2-point analog output module

Input Specifications	
Number of Channels	4, single ended (one common)
Input Range	0 to5VDC or 0 to 10VDC (jumper selectable)
Resolution	12 bit (1 in 4096)
Step Response	10.0mS to 95% of full step change
Crosstalk	1/2 count max (-80db)*
Active Low-pass Filtering	-3dB at 300Hz (-12dB per octave)
Input Impedance	>20KΩ
Absolute Max Ratings	±15V
Linearity Error (end to end)	±2 count (0.025% of full scale) max*
Input Stability	±1 count*
Gain Error	±6 counts max*
Offset Error	±2 counts max*
Max Inaccuracy	±0.3% at 25°C (77°F) ±0.6% at 0 to 60°-C (32 to 140°F)
Accurracy vs. Temperature	±100 ppm/°C typical

Output Specifications	
Number of Channels	2, single ended (one common)
Output Range	0 to5VDC or 0 to 10VDC (jumper selectable)
Resolution	12 bit (1 in 4096)
Conversion Settling Time	50μS for full scale change
Crosstalk	1/2 count max (-80db)*
Peak Output Voltage	±15VDC (power supply limited)
Offset Error	0.1% of range
Gain Error	0.4% of range
Linearity Error (end to end)	±1 counts (0.075% of full scale) max*
Output Stability	±2 counts*
Load Impedance	2KΩ max
Load Capacitance	0.01μF max
Accurracy vs. Temperature	±50 ppm/°C typical

** One count in the specification table is equal to one least significant bit of the analog data value (1 in 4096)*



NOTE 1: Ground shields at the signal source.
NOTE 2: Connect all external power supply commons.

High-Speed I/O Features

You can use the DL05 or DL06 micro PLCs to solve a diverse range of motion and high-speed machine control applications.

The DL05 and DL06 micro PLCs offer high-speed input and pulse output features exclusively on DC input and DC output models. On DL05 PLCs *with DC inputs*, the high-speed features are accessible on the first three input points (X0-X2). On DL06 PLCs *with DC inputs*, the high-speed features are accessible on the first four input points (X0-X3). On DL05 or DL06 PLCs *with DC outputs*, the pulse output feature is accessible on the first two output points (Y0-Y1).

Several modes of operation are available that meet the needs of many applications. A brief description of each of the high-speed modes is listed below:

- High-speed counters offer 24 presets. When the preset is reached, an interrupt routine is executed.
- Quadrature encoder input (up/down counter) for clockwise and counterclockwise position control
- Pulse outputs are programmable to follow a predetermined profile. An external interrupt can be used in conjunction with separate acceleration/deceleration profiles for positioning and velocity control.
- External interrupt inputs can be used for an immediate response to urgent application tasks.
- The pulse catch input allows the CPU to read an input with a pulse width as narrow as 0.1ms.
- Input filters are configurable (0-99ms) to ensure input signal integrity. The default input mode is a 10ms filter.
- Timed interrupts can be configured for time critical events. Interrupt 0 can be scheduled on a 5ms-999ms cycle. Interrupt 1, available exclusively on the DL05, can be scheduled on a 5ms-9999ms cycle.

Note: The high-speed counter features cannot be used if the pulse output features are in use, and vice versa.

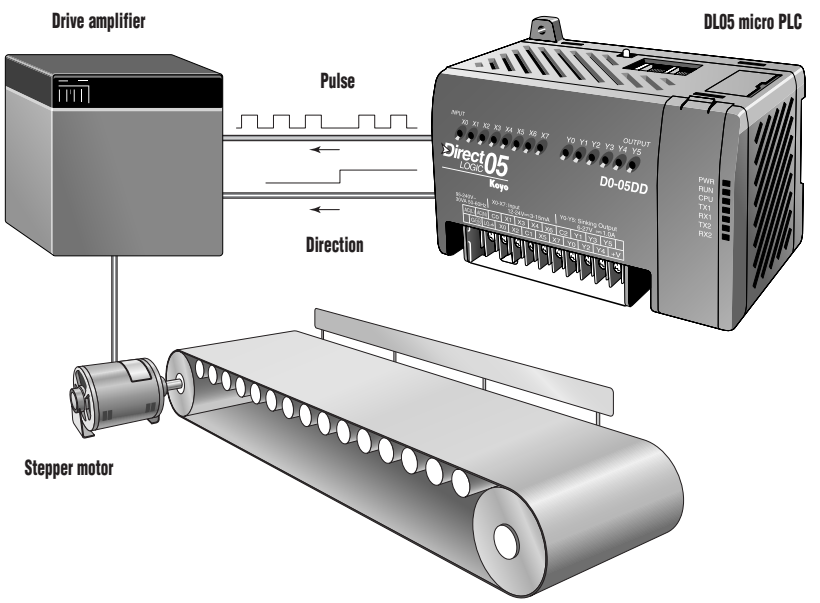
The operating modes are explained in more detail later in this section.

DL05 High-speed I/O Features

Mode	DC Inputs Points			DC Output Points	
	X0	X1	X2	Y0	Y1
High Speed Up Counter	Counter input	Filtered input	Reset count Filtered input	Regular output	Regular output
Quadrature Counter	Phase A input	Phase B input	Reset count Filtered input	Regular output	Regular output
High-Speed Interrupt	Interrupt input	Filtered input	Filtered input	Regular output	Regular output
Pulse Catch	Pulse input	Filtered input	Filtered input	Regular output	Regular output
Pulse Output	Filtered input	Filtered input	Positioning interrupt Filtered input	Pulse CW pulse	Direction CCW pulse
Filtered Input	Filtered input	Filtered input	Filtered input	Regular output	Regular output

DL06 High-speed I/O Features

Mode	DC Inputs Points				DC Output Points	
	X0	X1	X2	X3	Y0	Y1
High-Speed Up Counter	Counter Ch 1	Counter Ch 2 Interrupt Pulse input Filtered input	Reset Ch 1 Interrupt Pulse input Filtered input	Reset Ch 2 Interrupt Pulse input Filtered input	Regular output	Regular output
Up/Down Counter	Up input	Down input	Reset Pulse input Filtered input	Pulse input Filtered input	Regular output	Regular output
Quadrature Counter	Phase A input	Phase B input	Reset Pulse input Filtered input	Pulse input Filtered input	Regular output	Regular output
High-Speed Interrupt	Interrupt input	Interrupt Pulse input Filtered input	Interrupt Pulse input Filtered input	Interrupt Pulse input Filtered input	Regular output	Regular output
Pulse Catch	Pulse input	Interrupt Pulse input Filtered input	Interrupt Pulse input Filtered input	Interrupt Pulse input Filtered input	Regular output	Regular output
Pulse Output	Filtered input	Interrupt Pulse input Filtered input	Pulse input Filtered input	Pulse input Filtered input	Pulse CW Pulse	Direction CCW pulse
Filtered Input	Filtered input	Filtered input	Filtered input	Filtered input	Regular output	Regular output



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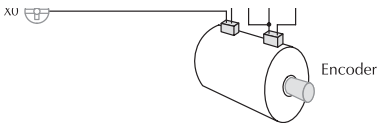
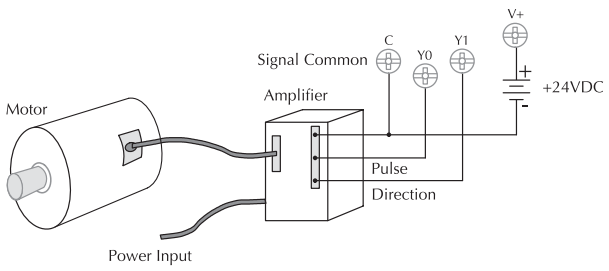
High Speed Specifications

High-Speed Input Specifications		
PLC	DL05	DL06
High-speed Inputs	3 pts. sink or source (X0-X2)	4 pts. sink or source (X0-X3)
Max. Input Frequency	5kHz	7kHz
Minimum Pulse Width	100 µs	70 µs
Input Voltage Range	12-24 VDC	
Input Impedance (hs only)	1.8K @ 12-24VDC	
ON Current/Voltage Level	>5mA/>10VDC	
OFF Current/Voltage Level	<0.5mA/<2VDC	
OFF to ON Response	<100µs	<70 µs
ON to OFF Response	<100µs	<70 µs

High-Speed Output Specifications		
PLC	DL05	DL06
Pulse Outputs	2 pts. (Y0 and 1) current sinking	2 pts. (Y0 and Y1) current sinking or sourcing (sourcing outputs on D0-06DD2 only)
Max. Input Frequency	7kHz	10kHz
Voltage Range	6-27VDC	
Max. Load Current	0.5A/point	
ON Voltage Drop	0.3VDC @ 1.0A	
Leakage Current	15µA @ 30VDC	
Inrush Current	2A (100ms)	
OFF to ON Response	<10µs	<10µs
ON to OFF Response	<30µs	<20µs

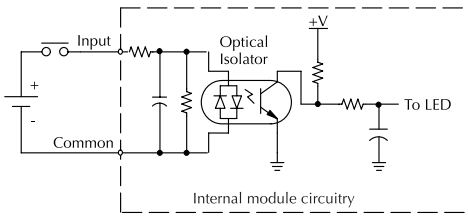


Pulse Input Wiring

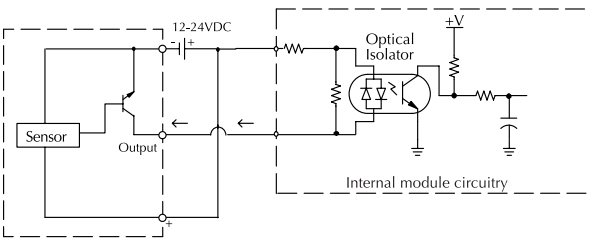


Pulse Output Wiring

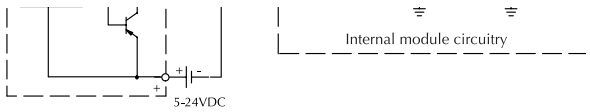
Equivalent Circuit, High-Speed Inputs



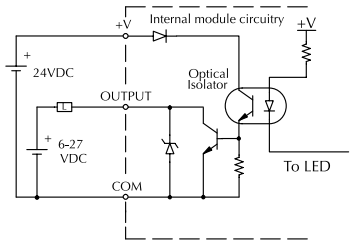
Equivalent Circuit, High-Speed Inputs (NPN) Current Sinking Field Device



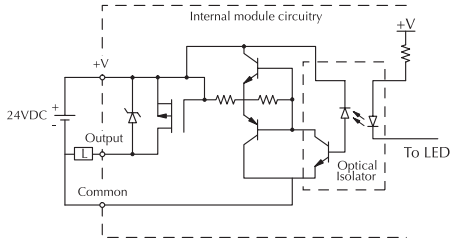
Equivalent Circuit, High-Speed Inputs (PNP) Current Sourcing Field Device



Equivalent Pulse Output Circuit Sinking Output



Equivalent Pulse Output Circuit Sourcing Output (D0-06DD2 only)



Mode 10: High Speed Up Counter

1-800-633-0405

Overview

The DC input versions of the DL05 and DL06 micro PLCs support high-speed counter inputs up to 5kHz for the DL05 and 7kHz for the DL06.

Access the high-speed counter by connecting the external pulse input and external reset signals to the internal counter at the designated discrete input points.

The embedded counter is independent of the micro PLC's ladder logic execution, so counting is not affected by the scan time. When the counter reaches any one of up to 24 preset values, the CPU stops executing the main RLL program and executes a special interrupt subroutine that is associated with the UP counter. The CPU resumes normal operations from where it left off after the interrupt subroutine has completed.

You can program the subroutine with any of the instructions that are normally available in subroutines. Also, each preset value has a corresponding *equal relay*. These are individual internal control relays that are turned on when the associated preset matches the actual count. This allows you to trigger actions based on the current count. For example, you could use *immediate I/O* instructions to provide a fast response.

Use an *up/down counter* box in your ladder logic and start and stop the counter just by turning on or off an enable contact (of your choice) as needed. Counters can be reset either by an external signal or by special internal relays that can be activated by your ladder program. Presets are absolute, which means they are compared directly to the actual count.

Up Counter Mode

DL05 Designated Terminals

X0: . . . . . Up count of up counter
X1: . . . . . Filtered input
X2: . . . . . External counter reset (or filtered input)

Input Specifications

Input voltage. . . . . 12 or 24VDC
Frequency DL05 . . . . . 5kHz maximum
Minimum pulse width. . . . . 100 µs
Maximum count 99,999,999
Preset types. . . . . Absolute
Number of presets 24

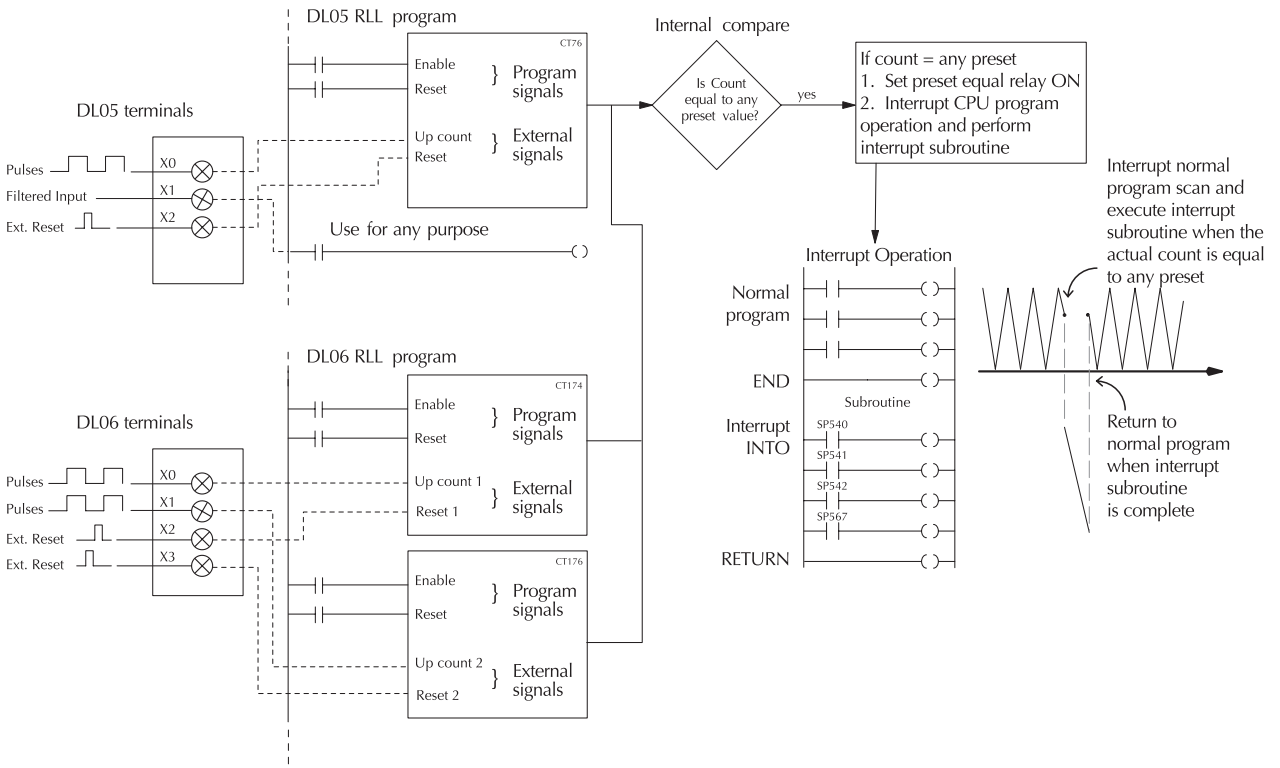
DL06 Designated Terminals

X0: . . . . . Up count of up counter 1
X1: . . . . . Up count of up counter 2
X2: . . . . . External counter 1 reset or filtered input
X3: . . . . . External counter 2 reset or filtered input

Input Specifications

Input voltage. . . . . 12 or 24VDC
Frequency DL06 . . . . . 7kHz maximum
Minimum pulse width. . . . . 70 µs
Maximum count 99,999,999
Preset types. . . . . Absolute
Number of presets 24

Example operation



Mode 20: Quadrature (or up/down) Counter

Overview

By selecting Mode 20, you can connect a quadrature encoder to the high-speed input terminals of a DL05 or DL06 PLC. In this mode, you can have two external pulse inputs from the encoder (Phase A and Phase B) and one reset input signal. These are connected to the terminals indicated in the adjacent table. In addition to the physical inputs, there are also two internal references used in the control program, a counter enable input, and a counter reset input. Note: the DL05 and DL06 micro PLCs support a maximum of one quadrature encoder (the DL06, however, will support two simple encoders).

As with the UP counter, the quadrature counter is independent of the CPU ladder logic execution. The actual pulse counting is not affected by the scan time. The quadrature counter cannot trigger an interrupt based on the current count/preset relationship.

To perform simple positioning or to control output devices, you must use relational contacts (based on the current count) within your RLL program. Since these contacts are within the RLL program, the resolution obtained with this method is actually limited by the PLC scan time. That is, the margin for error is equal to the maximum number of pulses that could be expected during one scan.

You can determine the resolution with a simple formula:

$$\text{Pulses per scan} = \text{Scan Time (ms)} \times \text{Frequency (kHz)}$$

For example, a 10ms scan and a 5kHz encoder input (0.01seconds x 5000Hz) yields a maximum of 50 pulses per scan. The maximum positioning precision would be the number of encoder revolutions that yields 50 pulses. The amount of precision will also depend on the field device delay, PLC output off/on delay, etc.). This amount of precision may be acceptable for many simple positioning applications.

If you need additional flexibility for your application, check out our DL205 micro modular family of PLCs and the H2-CTRIO counter module.

Quadrature mode

DL05 Designated Terminals

X0: . . . . . Phase A
X1: . . . . . Phase B
X2: . . . . . External counter reset (or filtered input)

Input Specifications

Input voltage . . . . . 12 or 24VDC
Frequency . . . . . 5kHz maximum
Minimum pulse width . . . . . 100 µs
Count range . . . . . 0 to 99,999,999 unipolar –
. . . . . -8,388,608 to 8,388,607 bipolar
Number of presets . . . . . None, use relational
. . . . . contacts or use CT76 status contact

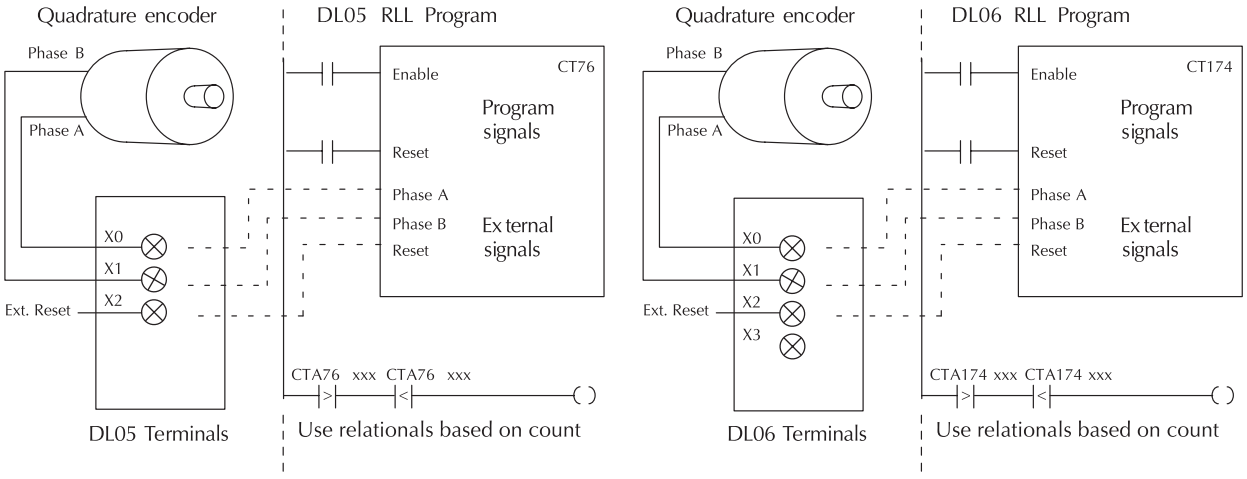
DL06 Designated Terminals

X0: . . . . . Phase A
X1: . . . . . Phase B
X2: . . . . . External counter reset (or filtered input)
X3: . . . . . Filtered input

Input Specifications

Input voltage . . . . . 12 or 24VDC
Frequency . . . . . 7kHz maximum
Minimum pulse width . . . . . 70 µs
Count range . . . . . 0 to 99,999,999 unipolar –
. . . . . -8,388,608 to 8,388,607 bipolar
Number of presets . . . . . None, use relational
. . . . . contacts or use CT174 status contact

Example operation



Mode 30: Pulse Output

Overview

By selecting Mode 30, you can use the pulse output feature to build simple motion and positioning control systems. Transfer and indexing tables are common applications. There are two operation profiles available (shown below). You choose the profile and motion parameters by using special CPU V-memory locations that are reserved for the high-speed I/O features. You can configure the pulse output for independent CW/CCW pulse train output, or step and direction. With independent operation, Y0 is the CW pulse output and Y1 is the CCW pulse output. If you choose step and direction, Y0 is the pulse train output and Y1 controls the CW/CCW operation (OFF/ON respectively). In either case, the pulses are sent out independently of the CPU scan, so scan time does not affect the pulse generation. The pulse output is enabled through ladder logic by activating Y0.

Automatic accel/decel profile

The trapezoid profile is also referred to as the automatic acceleration/deceleration profile. You specify a target destination (number of pulses), a starting velocity (pulses per second), a positioning velocity, an acceleration time, and a deceleration time. Once these parameters are specified, the DL05 or DL06 automatically controls the actual acceleration/deceleration. Times can be in the range of 100ms to 10 seconds. This profile also allows you to perform simple registration. By using the external interrupt, you can delay counting toward the target number of pulses until the interrupt occurs.

Velocity control

You can also choose a velocity-only profile. In this scenario, you only control the velocity. There is no target destination (number of pulses). You simply change the velocity value as necessary to achieve the desired results.

Pulse output mode

DL05 Designated Terminals

X0: . . . . . Filtered input
X1: . . . . . Filtered input
X2: . . . . . Positioning interrupt or filtered input

Output Assignments for Pulse Output Mode

Y0: . . . . . Independent mode, CW pulse output
. . . . . Step and direction mode, pulse output
Y1: . . . . . Independent mode, CCW pulse output
. . . . . Step and direction mode, OFF=CW, ON=CCW

Output Specifications

Output voltage range 6-27VDC
Frequency . . . . . 7kHz maximum
Target pulse range . . . . . -8,388,608 to 8,388,607
Velocity range . . . . . 40 to 7000 pulses/sec
. . . . . (in units of 10 pulses)

DL06 Designated Terminals

X0: . . . . . Filtered input
X1: . . . . . Positioning interrupt (or filtered input)
X2: . . . . . Filtered input
X3: . . . . . Filtered input

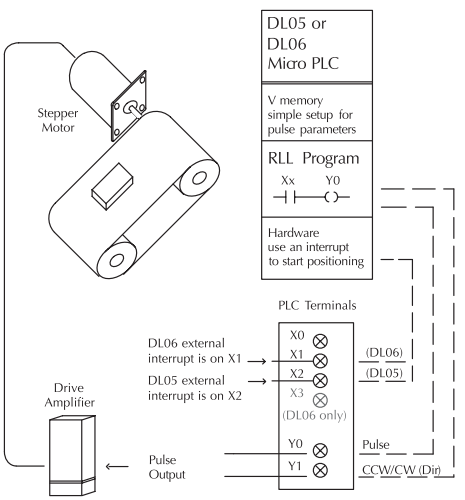
Output Assignments for Pulse Output Mode

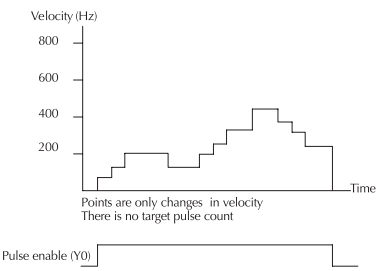
Y0: . . . . . Independent Mode, CW pulse output
. . . . . Step & Direction Mode, pulse output
Y1: . . . . . Independent Mode, CCW pulse output
. . . . . Step & Direction Mode, OFF=CW, ON=CCW

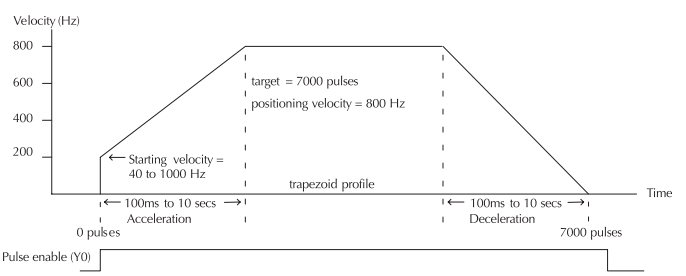
Output Specifications

Output voltage range 6-27VDC
Frequency . . . . . 10kHz maximum
Target pulse range . . . . . -8,388,608 to 8,388,607
Velocity range . . . . . 40 to 10,000 pulses/sec
. . . . . (in units of 10 pulses)

Example operation







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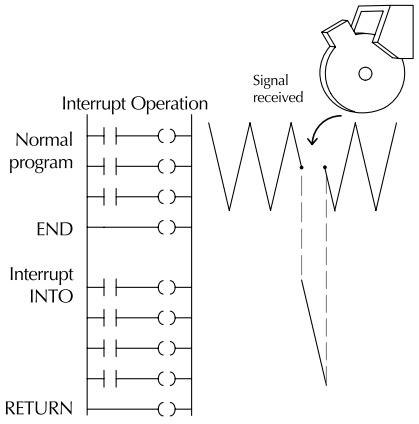
Mode 40 and Mode 50

Mode 40: external interrupt overview

By selecting Mode 40, you can use the designated terminals as a high-speed interrupt input. An interrupt input is especially useful in applications that have a high-priority event that requires special operations to be performed. When this high-priority event occurs, the interrupt input senses an ON input signal. The input automatically sends an interrupt request to the CPU. The CPU immediately suspends its routine scan cycle execution and jumps to an interrupt subroutine. You can program the subroutine with any of the instructions that are normally available in subroutines. For example, you could use immediate I/O instructions to immediately read inputs and update outputs without waiting on the normal I/O update cycle. When the subroutine is complete, the CPU automatically resumes the normal scan cycle starting from the exact location where it was interrupted. The CPU continues the routine scan until another interrupt signal is sensed.

A note on timed interrupts

If you use the external hardware interrupt (Mode 40), you cannot use the internal timed interrupt INT0. This is because they both share the same interrupt routine, INT0. Exclusively on the DL05, there is a second internal timed interrupt, INT 1.



Interrupt mode

DL05 Designated Terminals

X0: . . . . . Interrupt input
X1: . . . . . Filtered input
X2: . . . . . Filtered input

Input Specifications

Input voltage . . . . . 12 or 24VDC
Minimum pulse width. . . . . 100 µs
Pulse period . . . . . 0.5ms or greater
Trigger . . . . . Leading edge
Interrupt subroutine INT0

DL06 Designated Terminals

X0: . . . . . Interrupt input
X1: . . . . . Interrupt input (or filtered input)
X2: . . . . . Interrupt input (or filtered input)
X3: . . . . . Interrupt input (or filtered input)

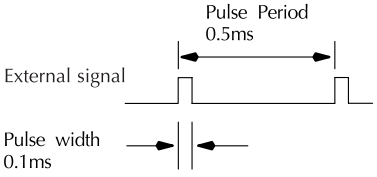
Input Specifications

Input voltage . . . . . 12 or 24VDC
Minimum pulse width. . . . . 100 µs
Pulse period . . . . . 0.5ms or greater
Trigger . . . . . Leading edge
Interrupt subroutine INT0, INT1, INT2, INT3

Mode 50: pulse catch input overview

By selecting Mode 50, you can use X0 as a pulse catch input. In this configuration, the DL05 or DL06 micro PLC can capture very fast (narrow) pulse inputs that cannot normally be detected during the normal input update cycle. You can detect pulse widths as small as 0.1ms (100µS) and a pulse period greater than 0.5ms (500µS). When an external pulse is encountered, X0 is set on for the next CPU scan, and then it is automatically set to the OFF state. Like the other modes, the pulse catch feature operates independently of the CPU scan and is not affected by scan time fluctuations.

Mode 50 is not recommended for high-speed pulse counting.



Pulse catch mode

DL05 Designated Terminals

X0: . . . . . Pulse catch input
X1: . . . . . Filtered input
X2: . . . . . Filtered input

Input Specifications

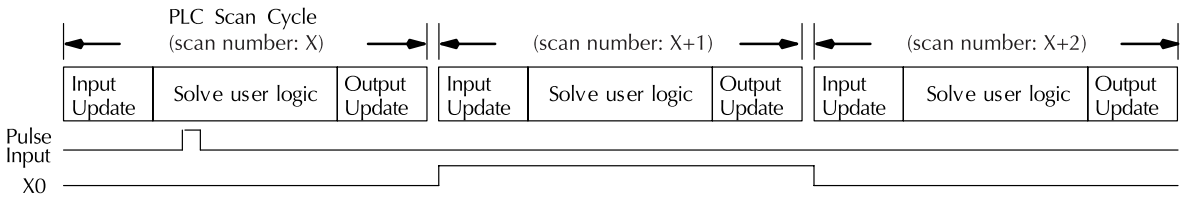
Input voltage . . . . . 12 or 24 VDC
Minimum pulse width. . . . . 100 µs
Pulse period . . . . . 0.5ms or greater
Trigger . . . . . Leading edge

DL06 Designated Terminals

X0: . . . . . Pulse catch input
X1: . . . . . Pulse catch input (or filtered input)
X2: . . . . . Pulse catch input (or filtered input)
X3: . . . . . Pulse catch input (or filtered input)

Input Specifications

Input voltage . . . . . 12 or 24 VDC
Minimum pulse width. . . . . 100 µs
Pulse period . . . . . 0.5ms or greater
Trigger . . . . . Leading edge



Default Mode 60 and Timed Interrupts

Default Mode 60: filtered inputs overview

Mode 60, which is the default mode set at the factory, provides selectable filtering for the designated inputs. Filtering can be especially useful because it reduces the possibility of false ON conditions (which can in turn trigger events in your ladder logic program). When an external signal is first detected (ON state), a programmable filter is activated, which begins a timed countdown. The slight delay temporarily prevents the CPU from reading the input during the normal input update portion of the scan cycle. The ON signal must stay present long enough for the filter to time out. If the ON signal stays present during the entire filter time, it is latched by the filter and accepted by the CPU during the CPU's normal input update portion of the scan cycle. The signal is latched for the remaining duration of the ON signal, plus an amount of time equal to the filter time. The filter time can be programmed from 0 to 99ms in 1ms increments (default is 10ms).

Filtered input

DL05 Designated Terminals

X0. . . . . Filtered input
X1. . . . . Filtered input
X2. . . . . Filtered input

Input Specifications

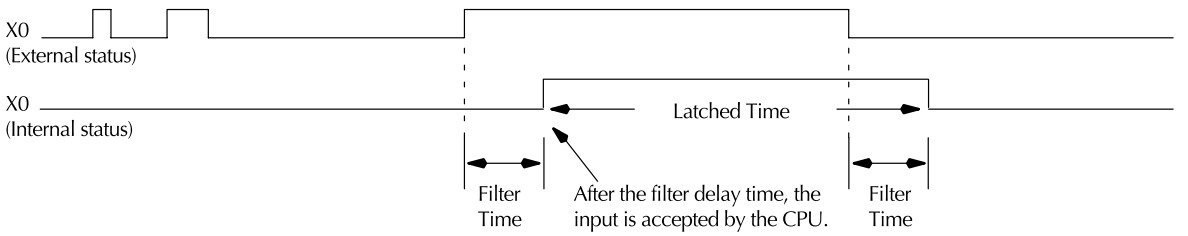
Filter time: . . . . . Programmable from
. . . . . 0-99ms in 1ms increments

DL06 Designated Terminals

X0. . . . . Filtered input
X1. . . . . Filtered input
X2. . . . . Filtered input
X3. . . . . Filtered input

Input Specifications

Filter time: . . . . . Programmable from
. . . . . 0-99ms in 1ms increments



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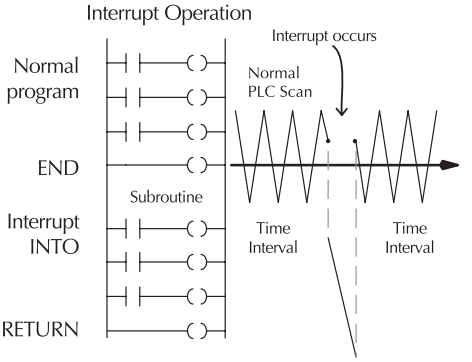
Understanding the timed interrupt

There is also a timed interrupt feature available in the DL05 and DL06 micro PLCs. This cyclical interrupt allows you to program a time-based interrupt that occurs on a scheduled basis. This feature is available in all units, regardless of input type.

The CPU's timed interrupt operates in a similar manner to the external interrupt input, but instead of the interrupt subroutine being triggered by an external event tied to X0, it is triggered by a cyclical interval of time. This interval can be programmed from 5ms to 999ms for INT0, which is available on either the DL05 or the DL06. The programmable time interval for INT1, which is available exclusively on the DL05, is 5 to 9999ms .

Whenever the programmed time elapses, the CPU immediately suspends its routine scan cycle and jumps to the selected interrupt subroutine. As with the other modes, when the interrupt subroutine execution is complete, the CPU automatically resumes its routine scan cycle starting from the location where it was interrupted. Because the CPU scan time and the interrupt time interval are different, the point at which the RLL program is interrupted can change over time.



DL05 Designated Terminals

X0: . . . . . Filtered input (uses filter time set for X1)

Timed Interrupt Specifications

Timed interrupts. . . . . 2 (internal to CPU)
Interrupt Subroutine INT0, INT1
Time interval . . . . . .
INT0 . . . . . 5 to 999ms (1ms increments)
INT1 . . . . . 5 to 9999ms (1ms increments)

DL06 Designated Terminals

X0: . . . . . Filtered input (uses filter time set for X1)

Timed Interrupt Specifications

Timed interrupts. . . . . 1 (internal to CPU)
Interrupt subroutine INT0
Time interval . . . . . .
INT0 . . . . . 5 to 999ms (1ms increments)

Instruction Set

Boolean Instructions

Store (STR) Begins a new rung or an additional branch in a rung with a normally open contact.

Store Not (STRN) Begins a new rung or an additional branch in a rung with a normally closed contact.

Or (OR) Logically ors a normally open contact in parallel with another contact in a rung.

Or Not (ORN) Logically ors a normally closed contact in parallel with another contact in a rung.

And (AND) Logically ands a normally open contact in series with another contact in a rung.

And Not (ANDN) Logically ands a normally closed contact in series with another contact in a rung.

And Store (ANDSTR) Logically ands two branches of a rung in series.

Or Store (ORSTR) Logically ors two branches of a rung in parallel.

Out (OUT) Reflects the status of the rung (on/off) and outputs the discrete (on/off) state to the specified image register point or memory location.

Or Out(OROUT) Reflects the status of the rung and outputs the discrete (ON/OFF) state to the image register. Multiple OR OUT instructions referencing the same discrete point can be used in the program.

Not (NOT) Inverts the status of the rung at the point of the instruction.

Set (SET) An output that turns on a point or a range of points. The reset instruction is used to turn the point(s) OFF that were set ON with the set instruction.

Reset (RST) An output that resets a point or a range of points.

Pause outputs (PAUSE) Disables the update for a range of specified output points.

Comparative Boolean Instructions

Store if Equal (STRE) Begins a new rung or additional branch in a rung with a normally open comparative contact. The contact will be on when A = B.

Store if Not Equal (STRNE) Begins a new rung or additional branch in a rung with a normally closed comparative contact. The contact will be on when A =/ B.

Or if Equal (ORE) Connects a normally open comparative contact in parallel with another contact. The contact will be on when A = B.

Or if Not Equal (ORNE) Connects a normally closed comparative contact in parallel with another contact. The contact will be on when A ≠ B.

And if Equal (ANDE) Connects a normally open comparative contact in series with another contact. The contact will be on when A = B.

And if Not Equal (ANDNE) Connects a normally closed comparative contact in series with another contact. The contact will be on when A ≠ B.

Store (STR) Begins a new rung or additional branch in a rung with a normally open comparative contact. The will be on when A > B.

Store Not (STRN) Begins a new rung or additional branch in a rung with a normally closed comparative contact. The contact will be on when A >_ B.

Or (OR) connects a normally open comparative contact in parallel with another contact. The contact will be on when A > B.

Or Not (ORN) connects a normally open comparative contact in parallel with another contact. The contact will be on when A < B.

And (AND) Connects a normally open comparative contact in series with another contact. The contact will be on when A > B.

And Not < (ANDN) Connects a normally closed comparative contact in parallel with another contact. The contact will be on when A < B.

Immediate Instructions

Store Immediate (STRI) Begins a rung/branch of logic with a normally open contact. The contact will be updated with the current input field status when processed in the program scan.

Store Not Immediate (STRNI) Begins a rung/branch of logic with a normally closed contact. The contact will be updated with the current input field status when processed in the program scan.

Or Immediate (ORI) Connects a normally open contact in parallel with another contact. The contact will be updated with the current input field status when processed in the program scan.

Or Not Immediate (ORNI) Connects a normally closed contact in parallel with another contact. The contact will be updated with the current input field status when processed in the program scan.

And Immediate (ANDI) Connects a normally open contact in series with another contact. The contact will be updated with the current input field status when processed in the program scan.

And Not Immediate (ANDNI) Connects a normally closed contact in series with another contact. The contact will be updated with the current input field status when processed in the program scan.

Out Immediate (OUTI) Reflects the status of the rung. The output field device status is updated when the instruction is processed in the program scan.

Or Out Immediate (OROUTI) Reflects the status of the rung and outputs the discrete (ON/OFF) state to the image register. Multiple OR OUT instructions referencing the same discrete point can be used in the program. The output field device status is updated when the instruction is processed in the program scan.

Set Immediate (SETI) An output that turns on a point or a range of points. The reset instruction is used to turn the point(s) off that were set. The output field device status is updated when the instruction is processed in the program scan.

Reset Immediate (RSTI) an output that resets a point or a range of points. The output field device status is updated when the instruction is processed in the program scan.

Timer, Counter, and Shift Register Instructions

Timer (TMR) Single input incrementing timer with 0.1 second resolution (0-999.9 seconds)

Fast Timer (TMRF) Single input incrementing timer with 0.01 second resolution (0-99.99 seconds)

Accumulating Timer (TMRA) Two input incrementing timer with 0.1 second resolution (0-9,999,999.9 sec.). Time and enable/reset inputs control the timer.

Accumulating Fast Timer (TMRAF) Two input incrementing timer with 0.1 second resolution (0-99,999.9 sec.). Time and enable/reset inputs control the timer.

Counter (CNT) Two input incrementing counter (0-9999). Count and reset inputs control the counter.

Stage Counter (SGCNT) Single input incrementing counter (0-9999) RST instruction must be used to reset count.

Up Down Counter (UDC) Three input counter (0-99,999,999). Up, down and reset inputs control the counter.

Shift Register (SR) Shifts data through a range of control relays with each clock pulse.The data clock and reset inputs control the shift register.

Accumulator/Stack Load and Output Data

Load (LD) Loads a 16-bit word into the lower 16 bits of the accumulator/stack.

Load Double (LDD) Loads a 32-bit word into the accumulator/stack.

Load Formatted (LDF) Loads the accumulator with a specified number of consecutive discrete memory bits.

Load Address (LDA) Loads the accumulator with the HEX value for an octal constant (address).

Out (OUT) Copies the value in the lower 16 bits of the accumulator to a specified V memory location.

Out Double (OUTD) Copies the value in the accumulator to two consecutive V memory locations.

Out Formatted (OUTF) Outputs a specified number of bits (1-32) from the accumulator to the specified discrete memory locations.

Pop (POP) Moves the value from the first level of the accumulator stack to the accumulator and shifts each value in the stack up one level.

Out Least (OUTL) DL06 Only. Copies the value in the lower 8-bits of the accumulator to the lower 8-bits of a specified V-memory location

Out Most (OUTM) DL06 Only. Copies the value in the upper 8-bits of the lower accumulator word (1st 16 bits) to the upper 8 bits of a specified V-memory location

Output indexed (OUTX) DL06 Only. Copies a 16-bit value from the first level of the accumulator stack to a source address offset by the value in the accumulator

Differential Instructions

Positive differential (PD) One-shot output coil. When the input logic produces an off to on transition, the output will energize for one CPU scan.

Store Positive Differential (STRD) Leading edge triggered one-shot contact. When the corresponding memory location transitions from low to high, the contact comes on for one CPU scan.

Store Negative Differential (STRND) Trailing edge triggered one-shot contact. When the corresponding memory location transitions from high to low, the contact comes on for one CPU scan.

Or Positive Differential (ORD) Logically ors a leading edge triggered one-shot contact in parallel with another contact in a rung.

Out Immediate (OUTI) DL06 Only. Outputs the contents of the accumulator to a specified V-memory location. The status for each bit of the specified V-memory location will reflect the status of the lower 16-bits of the accumulator. Typically used for output module V-memory addresses. Allows you to specify the V-location instead of the Y location and the number of points as with the OUTIF.

Or Negative Differential (ORND) Logically ors a trailing edge triggered one-shot contact in parallel with another contact in a rung.

And Positive Differential (ANDD) Logically ands a leading edge triggered one-shot contact in series with another contact in a rung.

And Negative Differential (ANDND) Logically ands a trailing edge triggered one-shot contact in series with another contact in a rung.

Load Immediate (LDI) DL06 Only. Loads the accumulator with the contents of a specified 16-bit V-memory location. The status for each bit of the specified V-memory location is loaded into the accumulator. Typically used for input module V-memory addresses. Allows you to specify the V-location instead of the X location and the number of points as with the LDIF.

Differential Instructions (cont'd)

Load Immediate Formatted (LDIF) DL06 Only. Loads the accumulator with a specified number of consecutive inputs. The field device status for the specified inputs points is loaded into the accumulator when the instruction is executed

Out Immediate Formatted (OUTIF) DL06 Only. Outputs the contents of the accumulator to a specified number of consecutive outputs The output field devices are updated when the instruction is processed by the program scan.

Logical Instructions (Accumulator)

And (AND) Logically ands the lower 16 bits in the accumulator with a V memory location.

And Double (ANDD) Logically ands the value in the accumulator with an 8-digit constant or a value in two consecutive V-memory locations.

And Formatted (ANDF) DL06 Only. Logically ands the value in the accumulator and a specified range of discrete memory bits (1-32)

And with stack (ANDS) DL06 Only. logically ands the value in the accumulator with the first value in the accumulator stack

Or (OR) Logically ors the lower 16 bits in the accumulator with a V memory location.

Or Double (ORD) Logically ors the value in the accumulator with an 8-digit constant or a value in two consecutive V-memory locations.

Or Formatted (ORF) DL06 Only. Logically ors the value in the accumulator with a range of discrete bits (1-32)

Or with Stack (ORS) DL06 Only. Logically ors the value in the accumulator with the first value in the accumulator stack

Exclusive Or (XOR) Performs an Exclusive Or of the value in the lower 16 bits of the accumulator and a V-memory location.

Exclusive Or Double (XORD) Performs an Exclusive Or of the value in the accumulator and an 8-digit constant or a value in two consecutive V-memory locations.

Exclusive Or Formatted (XORF) DL06 Only. Performs an exclusive or of the value in the accumulator and a range of discrete bits (1-32)

Exclusive Or with Stack (XORS) DL06 Only. Performs an exclusive or of the value in the accumulator and the first accumulator stack location

Compare (CMP) Compares the value in the lower 16 bits of the accumulator with a V memory location.

Compare Double (CMPD) Compares the value in the accumulator with two consecutive V memory locations or an 8-digit constant.

Compare with Stack (CMPS) DL06 Only. Compares the value in the accumulator with the first accumulator stack location

Instruction Set

Math Instructions (Accumulator)

Add (ADD) Adds a BCD value in the lower 16 bits in the accumulator with a V memory location. The result resides in the accumulator.

Add Double (ADDD) Adds a BCD value in the accumulator with two consecutive V memory locations or an 8-digit constant. The result resides in the accumulator.

Subtract (SUB) Subtract a BCD value, which is either a V memory location or a 4-digit constant from the lower 16 bits in the accumulator. The result resides in the accumulator.

Subtract Double (SUBD) Subtracts a BCD value, which is either two consecutive V memory locations or an 8-bit constant, from a value in the accumulator. The result resides in the accumulator.

Multiply (MUL) Multiplies a BCD value, which is either a V memory location or a 4-digit constant, by the value in the lower 16 bits in the accumulator. The result resides in the accumulator.

Multiply Double (MULD) Multiplies a BCD value contained in two consecutive V memory locations by the value in the accumulator. The result resides in the accumulator.

Divide (DIV) Divides a BCD value in the accumulator by a BCD value which is either a V memory location or a 4-digit constant. The result resides in the accumulator.

Divide Double (DIVD) Divides a BCD value in the accumulator by a BCD value which is either two consecutive V memory locations or a 8-digit constant. The result resides in the accumulator.

Add Binary (ADDB) Adds the binary value in the lower 16 bits of the accumulator to a value which is either a V memory location or a 16-bit constant. The result resides in the accumulator.

Add Binary Double (ADDBD) DL06 Only. Adds the binary value in the accumulator to a value which is either two consecutive V-memory locations or a 32-bit constant. The result resides in the accumulator

Subtract Binary (SUBB) Subtract a 16-bit binary value, which is either a V memory location or a 16-bit constant, from the lower 16 bits in the accumulator. The result resides in the accumulator.

Subtract Binary Double (SUBBD) DL06 Only. subtracts a 32-bit binary value, which is either two consecutive V-memory locations or a 32-bit constant, from the value in the accumulator. The result resides in the accumulator

Multiply Binary (MULB) Multiples a 16-bit binary value, which is either a V memory location or a 16-bit constant, by the lower 16 bits in the accumulator. The result resides in the accumulator.

Divide Binary (DIVB) Divides the binary value in the lower 16 bits in the accumulator by a value which is either a V memory location or a 16-bit constant. The result resides in the accumulator.

Add Formatted (ADDF) DL06 Only. Adds the BCD value in the accumulator to a value which is a range of discrete bits (1-32). The result resides in the accumulator

Subtract Formatted (SUBF) DL06 Only. Subtracts a BCD value which is a range of discrete bits (1-32) from the BCD value in the accumulator. The result resides in the accumulator

Multiply Formatted (MULF) DL06 Only. Multiplies a BCD value in the lower 16-bits in the accumulator by a BCD value which is a range of discrete bits (1-16). The result resides in the accumulator

Divide Formatted (DIVF) DL06 Only. Divides the BCD value in the lower 16-bits in the accumulator by the BCD value which is a range of discrete bits (1-16). The result resides in the accumulator

Add Top of Stack (ADDS) DL06 Only. Adds the BCD value in the accumulator with the BCD value in the first level of the accumulator stack. The result resides in the accumulator

Subtract Top of Stack (SUBS) DL06 Only. Subtracts the BCD value in the first level of the accumulator stack from the BCD value in the accumulator. The result resides in the accumulator

Multiply Top of Stack (MULS) DL06 Only. Multiplies a 4-digit BCD value in the first level of the accumulator stack by a 4-digit BCD value in the accumulator. The result resides in the accumulator

Divide by Top of Stack (DIVS) DL06 Only. Divides the 8-digit BCD value in the accumulator by the 4-digit BCD value in the first level of the accumulator by the 4-digit BCD value in the first level of the accumulator stack. The result resides in the accumulator

Add Binary Top of Stack (ADDBS) DL06 Only. Adds the binary value in the accumulator with the binary value in the first accumulator stack location. The result resides in the accumulator

Subtract Binary Top of Stack (SUBBS) DL06 Only. Subtracts the binary value in the first level of the accumulator stack from the binary value in the accumulator. The result resides in the accumulator

Multiply Binary Top of Stack (MULBS) DL06 Only. Multiplies the 16-bit binary value in the first level of the accumulator stack by the 16-bit binary value in the accumulator. The result resides in the accumulator

Divide Binary Top of Stack (DIVBS) DL06 Only. Divides a value in the accumulator by the binary value in the top location of the stack. The accumulator contains the result

Increment (INC) Increments a BCD value in a specified V memory location by 1 each time the instruction is executed.

Decrement (DEC) Decrements a BCD value in a specified V memory location by 1 each time the instruction is executed.

Increment Binary (INCB) Increments a binary value in a specified V memory location by 1 each time the instruction is executed.

Decrement Binary (DECB) Decrements a binary value in a specified V memory location by 1 each time the instruction is executed.

Number Conversion Instructions (Accumulator)

Binary (BIN) Converts the BCD value in the accumulator to the equivalent binary value. The result resides in the accumulator.

Binary Coded Decimal (BCD) Converts the binary value in the accumulator to the equivalent BCD value. The result resides in the accumulator.

Invert (INV) Takes the one's complement of the 32-bit value in the accumulator. The result resides in the accumulator.

ASCII to HEX (ATH) Converts a table of ASCII values to a table of hexadecimal values.

HEX to ASCII (HTA) Converts a table of hexadecimal values to a table of ASCII values.

Gray Code to BCD (GRAY) Converts a 16-bit GRAY code value in the accumulator to a corresponding BCD value. The result resides in the accumulator.

Shuffle Digits (SFLDGT) Shuffles a maximum of 8 digits, rearranging them in a specified order. The result resides in the accumulator."

Radian Real Conversion (RADR) DL06 Only. Converts the real degree value in the accumulator to the equivalent real number in radians. The result resides in the accumulator

Degree Real Conversion (DEGR) DL06 Only. Converts the real radian value in the accumulator to the equivalent real member of degrees. The result resides in the accumulator

Bit Instructions (Accumulator)

Sum (SUM) Counts the number of bits set to "1" in the accumulator. The HEX result resides in the accumulator..

Shift Left (SHFL) Shifts the bits in the accumulator a specified number of places to the left.

Shift Right (SHFR) Shifts the bits in the accumulator a specified number of places to the right.

Encode (ENCO) Encodes the bit position set to 1 in the accumulator, and returns the appropriate binary representation in the accumulator.

Decodes (DECO) Decodes a 5 bit binary value (0-31) in the accumulator by setting the appropriate bit position to 1 in the accumulator.

Set Bit (SETBIT) DL06 Only. Sets a single bit (to a 0) in a V-memory location

Reset Bit (RSTBIT) DL06 Only.. Resets a single bit (to a 0) in a V-memory location

Interrupt Instructions

Interrupt Routine/Interrupt Return/Interrupt Return Conditional (INT/IRT/IRTC) When a hardware or software interrupt occurs, the interrupt routine will be executed. The INT instruction is the beginning of the interrupt routine. The interrupt routine is terminated with an IRT of the interrupt routine. The in
interrupt routine is terminated with an IRT instruction (unconditional interrupt return). When a interrupt return is reached the execution of the program
continues from the instruction where the program execution was prior to the interrupt.

Enable Interrupt (ENI) Enables hardware and software interrupts to be acknowledged.

Disable Interrupt (DISI) Disables hardware and software interrupts from being acknowledged.

Table Instructions

Move (MOV) Moves the values from one V memory table to another V memory table.

Move Memory Cartridge/Load Label (MOVMC/LDLBL) DL05 Only. Copies data between V memory and program ladder memory.

CPU Control Instructions

No Operation (NOP) Inserts a no operation coil at specified program address.

End (END) Marks the termination point for the normal program scan. An End instruction is required at the end of the main program body.

Stop (STOP) Changes the operational mode of the CPU from Run to Program (Stop)

Reset Watchdog Timer (RSTWT) Resets the CPU watchdog timer.

Network Instructions

Read from network (RX) Reads a block of data from another CPU on the network.

Write to network (WX) Writes a block of data from the master device to a slave device on the network.

Message Instructions

Fault/Data Label (FAULT/DLBL) Displays a V memory value or a data label constant to the hand-held programmer or personal computer using DirectSOFT.

Numerical Constant/ASCII constant (NCON/ACON) Stores constants in numerical or ASCII form for use with other instructions.

Print Message (PRINT) Prints the embedded text or text/data variable message to the specified communications port. Maximum message length is 255 words.

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Instruction Set

Program Control Instructions

For/Next (FOR/NEXT) Executes the logic between the FOR and NEXT instructions a specified number of times.

Go to Subroutine/Subroutine Return Conditional/Subroutine Return (GTS/SBR w/RT) When a GTS instruction is executed the program jumps to the SBR (Subroutine). The subroutine is terminated with a RT instruction (unconditional return). When a return is executed, the program continues from the instruction after the calling GTS instruction.

Master Line Set/Master Line Reset (MLS/MLR) Allows the program to control sections of ladder logic by forming a new power rail. The MLS marks the beginning of a power rail and the MLR marks the end of the power rail control.

RLL^{PLUS} Programming Instructions

Initial stage (ISG) The initial stage instruction is used for a starting point for user application program. The ISG instruction will be active on power up and PROGRAM to RUN transitions.

Stage (SG) Stage instructions are used to create structured programs. They are program segments which can be activated or deactivated with control logic.

Jump (JMP) Normally open coil that deactivates the active stage and activates a specified stage when there is power flow to the coil.

Not Jump (NJMP) Normally closed coil that deactivates the active stage and activates a specified stage when there is power flow to the coil.

Converge Stages (CV) Converge stages are a group of stages that when all stages are active the associated converge jump(s). (CVJMP)will activate another stage(s). One scan after the CVJMP is executed, the converge stages will be deactivated.

Converge Jump (CVJMP) Normally open coil that deactivates the active CV stages and activates a specified stage when there is power flow to the coil.

Block Call/Block/Block End (BCALL w/BLK and BEND) DL06 Only BCALL is a normally open coil that activates a block of stages when there is power flow to the coil. BLK is the label which marks the beginning of a block of stages. Bend is a label used to mark the end of a block of stages

Drum Instructions

Tuned Drum with Discrete Outputs (DRUM) Time driven drum with up to 16 steps and 16 discrete output points. Output status is written to the appropriate output during each step. Specify a time base per count (in milliseconds). Each step can have a different number of counts to trigger the transition to the next step. Also define preset step as destination when reset occurs.

Time & Event Drum with Discrete Outputs (EDRUM) Time and/or event driven drum with up to 16 steps and 16 discrete output points. Output status is written to the appropriate output during each step. Specify a time base per count (in milliseconds). Each step can have a different number of counts and an event to trigger the counting. Once the time has expired, a transition to the next step occurs. Also define preset step as destination when reset occurs.

Time and Event Drum with Discrete Outputs and Output Mask (MDRMD) DL06 Only. Time and/or event driven drum with up to 16 steps and 16 discrete output points. Actual output status is the result of a bit-by-bit AND between the output mask and bit mask in the step. Specify a time base per count (in milliseconds). Each step can have a different number of counts and an event to trigger the counting. Once the time has expired, a transition to the next step occurs. Also define present step as destination when reset occurs.

Time and Event Drum with Word Output and Output Mask (MDRMW) DL06 Only. Time and/or event driven drum with up to 16 steps and a single V-memory output location. Actual output word is the result of a bit-by-bit AND between the word mask and the bit mask in the step. Specify a time base per count (in milliseconds). Each step can have a different number of counts and an event to trigger the counting. Once the time has expired, a transition to the next step occurs. Also define preset step as destination when reset occurs.

ASCII Instructions (DL06 only)

ASCII IN (AIN) Configures port 2 to read raw ASCII input strings.

ASCII Find (AFIND) Searches ASCII strings in V-memory to find a specific portion of the string.

ASCII IN (AEX) Extracts a specific portion from an ASCII string.

Compare V-memory (CMPV) Compares two blocks of V-memory.

Swap Bytes (SWAPB) Swaps V-memory bytes.

Print to V-memory (VPRINT) Used to send pre-coded ASCII strings to a predefined V-memory address when enabled.

Print from V-memory (PRINTV) Used to write raw ASCII string out of port 2 when enabled.

MODBUS Instructions (DL06 only)

MODBUS Read (MRX) Used CPU port 2 to read a block of data from MODBUS RTU devices on the network.

MODBUS Write (MWX) Writes a block of data from CPU port 2 to MODBUS RTU devices on the network.

Trigonometric Instructions (DL06 only)

Square Root Real (SQRTR) Takes the square root of the real number stored in the accumulator. The result resides in the accumulator.

Sine Real (SINR) Takes the sine of the real number stored in the accumulator. The result resides in the accumulator.

Cosine Real (COSR) Takes the cosine of the real number stored in the accumulator. The result resides in the accumulator.

Tangent Real (TANR) Takes the tangent of the real number stored in the accumulator. The result resides in the accumulator.

ARC Sine Real (ASINR) Takes the inverse sine of the real number stored in the accumulator. The result resides in the accumulator.

ARC Cosine Real (ACOSR) Takes the inverse cosine of the real number stored in the accumulator. The result resides in the accumulator.

ARC Tangent Real (ATANR) Takes the inverse tangent of the real number stored in the accumulator. The result resides in the accumulator.

LCD Display Instructions (DL06 only)

LCD Configures LCD display.

Extended Table Instructions (DL06 only)

Fill (FILL) Fills a table of specified V-memory locations with a value which is either a V-memory location or a 4-digit constant.

Find (FIND) Finds a value in a V-memory table and returns the table position containing the value to the accumulator.

Find Greater Than (FDGT) Finds a value in a V-memory table which is greater than the specified search value. The table position containing the value is returned to the accumulator.

Find Block (FINDB) Finds a block of data values in a V-memory table and returns the starting address of the table containing the values to the accumulator.

Table to Destination (TTD) Moves the value form the top of a V-memory table to a specified V-memory location. The table pointer increments each scan.

Remove from Bottom (RFB) Moves the value from the bottom of a v-memory table to a specified V-memory location. The table pointer increments each scan.

Source To Table (STT) Moves a value from a specified V-memory location to a V-memory table. The table pointer increments each scan.

Remove from Top (RFT) Pops a value from the top of a V-memory table and stores it in a specified V-memory location. All other values in the V-memory table are shifted up each time a value is popped from the table.

Add To Top of Table (ATT) Pushes a value from a specified V-memory location onto the top of a V-memory table. All other values in the V-memory table are shifted down each time a value is pushed onto the table.

Table Shift Left (TSHFL) Shifts s specified number of bits to the left in a V-memory table.

Table Shift Right (TSHFR) Shifts a specified number of bits to the right in a V-memory table.

Move Block (MOVBLK) Copies a specified number of words from a Data Label area of program memory (ACON, NCON) to a V-memory area.

And Move (ANDMOV) Copies data from a table to the specified location, ANDing each word with the accumulator data as it is written.

Or Move (ORMOV) Copies data from a table to the specified memory location, ORing each word with the accumulator data as it is written.

Exclusive Or Move (XORMOV) Copies data from a table to the specified memory location, XORing each word with the accumulator data as it is written.

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